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OF

AGRICULTURE, ARTS AND COMMERCE.

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INTRODUCTION.

1.—Patience and Perseverance of Indian Cultivators.

It is admitted on all hands that the cultivators of India are "the most patient, hard working, and, in many cases, skilful agriculturist that can be found on the face of the earth. Inured to privation, accustomed to maintaining life on short meals, and with scanty clothing, they give their labor for the smallest return it is possible to conceive." But by strange irony of fate, his patience, perseverance, skill and, we may also add, parsimony, do not even enable him to make at best both the ends meet. The spectacle of a peasantry, patiently toiling on his small bit of land from before sunrise till long after sunset, and so on, from the beginning to the end of the year; and slowly plying his weary steps homeward, perhaps to partake, with his family, of a scanty dinner hardly sufficient for one person, and thus to live in a state of chronic starvation, suggests matters for serious consideration, especially when we remember that the very modest sum of 3 to 4 pice is quite sufficient to give him one full meal a day.

2.—An Agricultural Paradox.

We are very often told that the practice of Indian agriculture is perfection; but how then are we to account for the strangely anomalous sight of a starving peasantry, existing side by side with such perfect state of agriculture as some would have us believe,—with such efficient means of living as leaves nothing to be desired? We admit that systems of agriculture which are practised in different parts of this vast country, may, so far as they go, suit local circumstances, but unfortunately they do not go far enough; and we are not prepared to abide by the *dictum* that they are *not* capable of improvement and that those engaged in them have *nothing* to learn.

3.—Its Aim.

The chronic state of starvation of a most hard-working peasantry in a country pre-eminently agricultural, is, as we have said, a very serious matter; and this unpretentious little publication will aim at striking at the root of the evil, by giving to both landlords and tenants, to big tenant farmers and small ryots, in fact to all having interest in land, a clear and thorough insight into the practice of agriculture in India and other countries, with a view to make them take an intelligent interest in their own practice and improve upon it if need be.

4.—Subjects to be discussed in it.

To realise the end in view, the paper will discuss the characteristics and capabilities of different soils; the most suitable crops for the various soils and climates of different provinces; the most successful way of raising the chief staples and preparing them for the market; the insect and other pests that attack vegetation; the effects on crops of irrigation as applied in different ways; the improvement of agricultural implements; the formation, extension and improvement of permanent pasture; the introduction and preservation of fodder crops; and the principles

of manuring and the most suitable manures for various soils and crops of different provinces.

Another very important point which this journal will bring home to the Indian cultivators and which one is very apt to loose sight of, is, that cattle plays as much an important part in agriculture as the head does in the human body. Special attention should, therefore, be paid to improving the systems of breeding, rearing and feeding cattle and to the means of prevention of cattle diseases, especially those which are contagious infectious or zymotic. Sheep and goat as flesh and woolmakers, and also agricultural horses will fall under the scope of this publication, which will also be a valuable record of agricultural, vital and economic statistics including forecast of weather and crops of different provinces, and which will quote market prices of the important articles of trade and commerce.

5.—*Scope of Arts in the Agricultural Economy of the Country.*

The improvements aimed at in this journal, instead of stopping at agricultural produce, will be extended to manufactures, which India now produces on a small scale or in a crude form and which with some improvement might be expected to find enlarged sales or could take the place of similar articles now imported from foreign countries. Manufacture and refining of sugar, tanning of hides, manufacture of cotton and jute fabrics, making of earthenware pots porcelain and glass may be indicated as subjects to which the above remarks would apply. It will be thus seen what relation Arts hold to agriculture and how they increase the material wealth of the country.

6.—*Relation of Commerce to Agriculture.*

Agriculture produces raw materials; Arts manufacture and make them fit for human use; Commerce, then, steps in and helps both, by regulating export, import and even distribution of these materials, produced by agriculture and manufactured by Arts.

7.—*Scope of Arts and Commerce in the Economy of the Country.*

Arts and Commerce will thus find occupation for a certain portion of the population and thereby relieve land of a part of its burden. No scheme of agricultural reform will be complete which does not include the introduction of diversity of occupation through which surplus population may be drawn from agricultural pursuits and led to find means of subsistence in manufactures or some such employments.

8.—*Want of a Journal of Agriculture.*

At present there is no paper in the whole continent of India dealing with these subjects adequately and in a popular form, and who will question that now, when agriculture is engaging the attention of the public all over India, a paper discussing agricultural and economic questions fully and popularly is urgently wanted? "The Indian Agricultural Gazette" will supply this want and it is not a moment too soon that the journal is going to make its appearance before the public.

9.—*Staff of the Journal.*

The subjects herein discussed will be handled with a unique mastery and by persons who are most competent to treat them. Writers with experience of economic questions both foreign and Indian, and specialists with intimate local knowledge and regular scientific training in European Colleges, will be its principal contributors. The Directors of Agriculture, Secretaries of Agri-Horticultural Societies, and Principals of Government Colleges of Arts and Agriculture in different provinces, will, it is hoped, co-operate with us in carrying the scheme to a succesful issue.

10.—*Diffusion of Information to all Classes of Poeple.*

To place the journal in the hands of people of all classes and means in life, it will be published both in English and Bengali, with a yearly subscription of Rs. 4, inclusive of postage, for the former, and Rs. 3 for the latter edition.

11.—*Public Appreciation.*

The Punjab, N. W. Provinces, Bengal, Central Provinces, Bombay, Madras, Assam and the Native States will claim our attention equally. We confidently hope that the Indian public will appreciate our earnest efforts and come to our help, in making the paper a success. The managing body intend turning it soon into a weekly, but it rests entirely with the public to give them necessary encouragement.

England as a Market for Indian Wheat.

It is one of the signs of the time that the Indian export trade, providing ready and profitable market for our raw agricultural produce and giving occupation to our surplus population which would otherwise have been dependent on agriculture, has been steadily developing and engaging the attention of the Government, from "the point of view of the resources which it derives immediately therefrom, no less than that which it has in the other main branches of its revenue." The Budget estimate for 1884-85 showed a surplus revenue of £ 319, 300 over expenditure. "To those who have watched the course of trade during the year, it will be matter of little surprize that the small surplus of the Budget was not realized." The fall in the exports of wheat, diminishing in consequence the railway earnings; and also fall in the exports of rice and consequent diminution of the Customs duties have mainly contributed to this result. This depression in Wheat and Rice trade, especially the former, and consequent loss of revenue may, however, be easily shown to be temporary, as the causes which have brought about this, viz., a good harvest in England and large stocks in America, do not affect Indian wheat-growers permanently.

Firstly, a good harvest in England is more an exception than a rule. During eleven years from 1866 to 1876, there was really one good harvest, namely, that of the year 1868, the average outturn per acre for that year being 4½ bushels over the average; and two more of partially good ones, namely, those of 1870 and 1874, the average outturn being 2½ bushels and 1½ bushels respectively over the average. While during the same period, there were four harvests *much under the average* viz. 4½ bushels less than the average produce in 1867, 6½ bushels in 1872, 4½ buskels in 1873 and 6½ bushels in 1875; and four harvests *under average*. Similarily, during the next eight years from 1877 to 1884, only the last harvest was a good one.

Secondly, the average acreage under wheat crop in the United Kingdom during eleven years (1866 to 1876) was 3,712,000, the maximum being 3,951,000 and minimum 3,124,000 acres. During four years preceding 1884, the average diminished to 2,977,533 acres, the maximum being 3,163,899 and the minimum 2,713,282. This steady diminution of acreage under wheat and the unusual preponderance of bad harvest over good ones, are no doubt, due to continuous wet weather at seed and harvest times and unusual wet summers, along with difficulty of tillage operations and high wages of labor; and as these causes are by no means temporary, the prospect of British wheat growers is very gloomy. In fact, wheat farming has almost ceased to be a paying business, excepting in places exceptionally situated.

The report of the state of agriculture in the British Isles, presented to the Agricultural Congress held during the period of the International Exhibition at Paris, tells us that in "the past 10 years (1869-1878) there has been a gradual reduction of the acreage and produce of wheat in the country (England) and a more than corresponding increase in the foreign supply; the result of which is that we now receive our bread in equal proportion from our own fields and those of the stranger." From a table constructed to accompany the foregoing report, it is seen that the quantity of wheat consumed annually in the United Kingdom was 110,000,000 cwts., of which half was homegrown and half foreign.

Wheat Import	1879	1880	1881
	cwts.	cwts.	cwts.
Total foreign import	70,098,678	65,787,886	68,403,079
From Russia ...	7,975,144	2,880,108	4,018,895
From the United States.	42,839,977	45,998,221	43,734,489
From India	887,256	3,247,242	7,308,842

Wheat Import	1882	1883	1884
	cwts.	cwts.	cwts.
Total foreign import	77,200,327	80,373,973	62,217,516
From Russia	9,571,021	13,293,358	5,401,964
From the United States.	42,836,885	37,336,750	32,946,697
From India	8,477,479	11,243,597	8,009,909

From the above table it is evident that excepting during the last year, the import of foreign wheat into England has been steadily increasing, which, however, follows as a matter of course from the continuous diminution of acreage under wheat crop. All these facts taken together prove to demonstration that England will be always dependent on foreign wheat for her bread, and that as long as the present factors of her agricultural economy continue, her dependency on foreign countries for wheat will go on increasing, excepting occassionally as during the last year.

Now, the countries which mainly supplied the British deficiency hitherto, were Russia and the United States. Thus in the year 1879, the American import into England amounted to 61·1 per cent. and the Russian to 10 per cent. of the whole quantity im-

ported, and the import from India amounted only to 1·2 per cent.

At the close of the year 1883, the American import was 46·4 per cent. and the Russian 16·5 per cent. as against 61·1 and 10 per cent. respectively in 1879; while the Indian import rose from the insignificant amount of 1·2 per cent in 1879 to 13·9 in 1883. This enormous rise of Indian import in such a short time speaks for itself. Even during the last year, with good harvest in England and depression of import trade in general, the Indian import contrasts very favourably with the Russian trade, the former standing at 12·8 per cent. and the latter at 8·6 only. Although there was a slight increase, on the previous year, in the percentage of American import, the total import from the latter country had fallen by about 6 million cwts.

The foregoing facts and figures show clearly that India has grown to be a formidable competitor with America and Russia in the English wheat market, and bids fair to monopolize in time the whole trade, provided she can grow enough wheat for the purpose. A calculation given by Mr. W. C. Bennet, late Director of Agriculture, N. W. Provinces, tells us that the price for exporting wheat from Delhi, Fyzabad and Lahore to London, would be from Rs 45-2 to Rs 32-11 and that from America Rs 45-5. With these figures before us, we cannot help asserting with confidence that though the present outlook of wheat trade for India is somewhat gloomy, this depression is only due to extreme speculative trade and therefore cannot but be temporary. As long as the present low prices of labor continue in India, —and no country in the world can compete with her in this—Russia can never afford to sell her wheat at so low prices in English Market as India can. Besides, it is certain that the low price for wheat which prevailed in English Market last year was very exceptional and, as we have said, due mainly to extreme speculative trade. For instance, at 30*s*. 10*d*. per quarter at which wheat was quoted in London in December last, it was impossible that either America or India could send her wheat to England; and such a low price has never been known for the last 100 years or more. England does not grow even half the quantity of wheat required for her home-consumption, to supply the deficit of which she must look to foreign countries and offer them fair price. And it is therefore impossible that the price could ever stand at such a low figure. Already prices have shown a tendency to rise in the London-market and will ere long assume a figure which, though prohibitive to America, will allow Indian cultivators to profitably send their wheat to London-market.

With the present cost of growing, of transporting from the place of growth to the nearest port, and of freight, India even now can afford to undersell America in London-market and with the further extension of railways, roads, canals and other means of communication which are being annually improved, India will in time be able to send her wheat to England at a much lower price, and to practically close the door of English market against her present formidable competitor—America.

Let us now turn to another side of the question. Are we in a position to totally or mainly supply the British demand? Could our resources be found sufficient for this? From a recent memorandum we learn that last year, the total area under wheat in British India was 26,000,000 acres, the total yield of grains 135 million cwts., and the total export 22½ million cwts., without any appreciable effect in raising prices. From this short statement of our present position, it is evident that our resources which have already been opened up and worked according to our present system, are quite inadequate to meet the English demand to any very great extent, that to monopolize the British-market we shall have either to extend the area of wheat cultivation or adopt improved methods of farming, or to do both. Leaving this purely agricultural side of the question for our next issue, we proceed to show that on many grounds than one, it would be advisable for England to depend for her bread more on India than on either America or Russia. If the trade be developed to the extent that we desire it to be, it will be the source of a large revenue to the Government, no less than a means of finding occupation for the large surplus Indian population which are already pressing too heavily on the land. It is the first duty of every civilized Government to see that a nation committed to its care is properly fed and decently clad, and any steps taken by the Government of India to relieve the land by drawing the surplus population from agricultural pursuits, would be a boon to the country. The development of our wheat-trade with England will be one of these steps. Such a step while increasing the traffic in railways will also be the source of a revenue which will introduce an element of elasticity absolutely essential for Revenue administration of this country. Whatever be the advantage of this in times of peace, it would be invaluable during periods of political complications. Chances for Russia and America stopping their import are far greater than for India doing so. In times of emergency, India could be more safely counted upon than any of the former countries and it would be for the interest of both India and England that it should be so. The demand for Indian wheat is daily increasing in the British market and the India Government should grasp the idea of supplying this demand.

FAMINE.—*Its Past Present and Future.*

HARDLY a year passes without some part of India or other being visited with famine and scarcity, to prevent the recurrence of which in future is the great problem waiting a practical solution at the hands of our administrators. But until this solution is arrived at, and as long as Indian agriculture depends on rainfall,—a very unsafe and variable element of Indian agriculture,—famines will be necessarily recurring calamities. A long time elapsed before the conviction was attained that famines were regular events in the history of India, to limit the extent and minimize the severity of which, provisions must be made beforehand. This result was no doubt due to almost total absence until within comparatively recent times, of trustworthy statistical knowledge. Even now, the importance of knowledge of this description is but very imperfectly appreciated by the Indian public. Thanks to the efforts of the Famine-Commission, the Imperial and Provincial Governments rising to the importance of the matter, have taken or are taking steps to provide agencies for collecting and permanently recording reliable agricultural. vital and economic statistics, which is one of the principal instruments on which the Government of the country must rely in preparing for its conflict with famines.

It is a belief commonly shared by most of us, that now-a-days droughts are becoming more common and famines more frequent than they formerly used to be; and in the absence of trustworthy contemporary records, it is impossible to pronounce any very decided opinion on it. Remembering, however, that agricultural operations in India have always been at the mercy of periodical rainfalls, the total absence or untimely cessation of which leading to failure of food crops on which the subsistence of the population depends, is sure to bring on famine of more or less severity. We are not warranted to presume that famines were rare or less frequent in past times, regard being specially had to the fact that rainfall in past must have been as irregular and unreliable as at present. Referring to this belief, the Famine Commission write that "bearing in mind the far greater attention paid to the visitations recently, our general conclusion is adverse to such a supposition."

From a careful study of the history of all past famines of this century, we gather that all famines and scarcities were invariably preceded by and directly connected with drought, that they were more or less disastrous according to the severity and duration of drought, that the recurrence of these droughts and consequent famines are inevitable in the present state of India, and that, excepting Burma and East Bengal "where the rainfall has never been known to fail," and Sindh where the population is wholly dependent on glacier-fed river-irrigation, no part of India has escaped the visitation of severe famines. We cannot do better than quote here the words of the Famine Commission. "The devastating famines to which the provinces of India have from time to time been liable, are in all cases to be traced directly to the occurrence of seasons of unusual drought * * *. These conclusions may be otherwise summed up by stating that the Government of India must be prepared for the recurrence of scarcity in some degree of severity and in some part of the country as often as two years out of every nine; and that great famines may be anticipated at average intervals of 12 years. The danger of extreme famine in any one province or locality arises on the average not oftener than once in fifty years; though drought followed by severe distress may be expected as often as once in eleven or twelve years."

In the present state of India, without almost any means to make agriculture independent of rainfall, famines *will* happen, to limit the extent and minimize the effects of which permanent administrative measures cannot be too strongly recommended. In the language of the above Commission, "administration of famine relief would be more efficiently carried out and controlled, if the measures it requires instead of being started afresh as each occassion arises, in the manner which at the moment seems most convenient, were not only conducted on a well-considered and pre-arranged plan, but also placed definitely and permanently under some special branch of the secretariat both in the Goverement of India and in the local Governments." Following the lines of this suggestion, the Imperial and most of the local Governments have organized special Departments, with a view to secure "permanent" and "definite" measures recommended by them. The Bengal Government which, perhaps owing to exceptional form of land-tenure prevalent in the province, had heitherto hesitated to take any very decided action on the recommendation, have lately started a similar Department. Bills are already before the council for efficient collection and permanent record of agricultural, vital and economic statistics on which the commission had laid particular stress as being the only instrument on which systematic measures for warding off future famines may be safely based.

Leaving to some future issue the subject of efficient relief administration in times of famines, we shall now confine our remarks to some per-

manent administrative measures for protection and prevention of future famines. The primary object of all such measures should be to permanently lessen the area, the cultivation of which is mostly or entirely dependent on rainfall. But of the whole area of 197,250,000 acres ordinarily cultivated in whole India, 29,220,000 acres or 14·8 per cent are ordinarily irrigated, and in seasons of severe and extensive droughts, the percentage may be expected to fall even considerably lower. If we take 10 per cent of the total cultivated area as well irrigated and free from any fear of drought, the remaining 90 per cent shall have to be provided for; and looking to the magnitude and importance of the work to be done, we can not too strongly press upon the imperial as well the provincial Governments the advisability of annually setting apart in their budget, a sum for the construction of irrigation works which would lead to permanently diminish the area of unirrigated cultivated land. By adopting this policy, the measure will have secured to it that element of permanency which is essential to it and which, if not entirely lost sight of by the administration, has, it is certain, never received the amount of care and attention which it deserves. No administrative measure could be more erroneous than to spend crores of rupees on famine relief as occasion arose, in places where a much less amount timely spent would give protection to the country against drought in future. For instance, in the province of Bengal where the system of irrigation is least developed and the percentage of irrigation to cultivation is as low as 1·8 (average in India being 14·8), a sum was spent on Behar famine relief during 1873—74, which, according to the showing of the Commission, was "far greater than what would have given permanent protection to the country against drought in the future"

Of all the provinces of India, Bengal and Bombay are sadly deficient in irrigation works. If we exclude East Bengal which is exceptionally favoured by rainfall, we do not see our way in upholding the verdict of the commission that "in this province ... ... artificial irrigation is hardly necessary." Perhaps the deficient information concerning Bengal of which the commission complain in the very same paragraph, led them to record this rather hasty judgment. We know for facts that west and north Bengal and parts of Behar and Orissa not protected by irrigation canals, are as much subject to droughts as other parts of India, and this, read with the light of the present events, will leave no doubt that they are so. Completion of the Saone canal; construction of new irrigation works on both banks of the Gundak in Tirhut, Champaran, and Saran; and formation of distributaries to the trunk canals of Orissa should claim more attention from the administration than at present and absorb more revenue which is now being frittered away in works of far less consequence.

Excepting Midnapur canal, there was no irrigation work whatsoever in west Bengal until very lately. It is hardly over three years that the Eden canal has been opened, but still in this short time irrigation from this canal has been so much appreciated that during the last season of drought we knew there were thousands of applications before the magistrate of Burdwan, to have the use of the canal water, conducted thorough distributing channels made for the time being. The canal had thus been the means of saving the crops of a few thousands of acres in the districts of Burdwan and Hugli, which would otherwise have increased the area of the present distressed tract. We would strongly urge the administration of this province to extend the range of the Eden canal by providing suitable distributing channels, to provide sluice-gates on the embankments of both sides of the Damudah, which, with a comparatively small outlay, may be made to serve the purpose of the Sindh inundation canals; and to excavate new tanks or repair old ones, in places where the inundation water would not go or could not be economically carried. In addition to these, embankments or dams might be thrown across small rivers or streamlets, to create temporary reservoirs behind the dams and utilize the water thus stored for agricultural purpose. Besides, the head of water at these places might be very cheaply and quite easily used as motive power to drive mills and serve like purposes.

Cultivation of Wheat in Oudh.

As there is a great future for Indian wheat, we propose giving a short sketch of wheat cultivation as practised in Oudh and comparing it with the practice as followed in England, the best wheat growing county in the world.

THE PLACE OF WHEAT IN ROTATION.—The general practice in Oudh is to grow wheat on fallow lands, that is, lands which have been left unsown for one year and, during that time, have been ploughed several times, the soil being made loose by exposure to the rays of sun and action of air and weeds uprooted and killed. Besides such lands, wheat is also successfully grown on lands from which a previous crop of pulse, jowar (millet) or til (oilseed)

or sometimes even sugarcane has been reaped. Wheat is sometimes grown though to a very limited extent on other lands but it requires very hard labor and extensive dressings of manure to grow good wheat on the latter class of lands

MANURING.—The cultivation of wheat begins with carting to the fields farm-yard manure, about 30 large basketfuls of which are put on every acre and then spread and and ploughed in. This is usually done in May and June, the manure being usually made in the homestead of the cultivator.

PLOUGHING.—Ploughing, as we have said, begins by May and June and goes on till sowing time. The minimum number of ploughings given to the soil is 10 and the maximum 20, the number necessary to raise a good tilth depending great deal on the nature of the soil whether heavy clay or free working light loam. After every ploughing the clods are broken by a sort of roller made of a heavy piece of wood and dragged by 4 bullocks. When by constant ploughing and rolling, the land is got into condition and a smooth surface secured, it is divided into beds to facilitate irrigation, the beds being in number from 75 to 100 per ⅓ acre if to be irrighated from wells, and from 40 to 50 if by *Hoogla* or irrigating vessels.

SOWING.—Sowing commences from the latter end of September or the beginning of October and goes on till November. Some well-to-do farmers hire a flock of sheep with the shepherd, and fold them on to his field for one or two nights. The shepherds are paid in kind at the rate of 12 to 15 seers of grain for one acre. The land is not merely enriched by the droppings but also highly benefited by the uniform treading of the sheep. This gives to the land the necessary consolidation for successful wheat growing. It is for this reason the English farmers say that the hoofs of sheep are golden. In sowing, the ploughman guides the plough and a woman or a man following with a basket of seed-wheat, distributes the latter into the scratches made by the plough. The average weight of seeds sown per one-third acre is 50 lbs. or 12½ seers. Attention is not paid to sowing 'pure' seed.

WEEDING—Weeding is not only unknown for wheat or other rabi crops but is thought by the cultivators to be useless and even injurious to the standing crop.

Here is a vast field for agricultural reformers to drive home to the farmers the fact that weeds not only rob the crop of its valuable food but also spoil the purity of the sample and reduce the marketable value of the grains. A small sum of money invested in weeding will be more than repaid by the improvement both in quality and quantity of the grains.

IRRIGATION.—There are two systems of irrigation (1) from tanks jhils or rivers and (2) from wells :— The watering from tanks is done by baskets worked by men, and costs Rs. 1-12 per ⅓ acre. One basket with 4 men can irrigate 1¼ to 2⅔ acre of land, if the water is close by and the land even. The watering from wells is done by vessels called Ghara or Pur; or by a sort of lever arrangement called Dhekli. The average cost of irrigation from Ghara per acre is about Rs. 2-4 and from Pur about Rs. 3-12-3. Dheklis do very scanty work and are only resorted to by very poor cultivators.

The well to do class irrigate their wheat thrice—once from twenty days to a month after the seed germinates, once again when the plants are about to blossom, and the third time, when the crops are in ears. Others leave the land with one or at most two waterings only. On river banks and moist soils, no irrigation is necessary.

CIRCUMSTANCES INJURING OR OTHERWISE DAMAGING THE CROP.—Clear sky and west winds are very favourable and a little rain in November and December very welcome. But east winds and damp atmosphere are very injurious. The diseases to which wheat is most subject and which do most damage are *mildew* (Garwi,) *smut* (Dhorn) and *Bunt* (Gaudo). All of them are fungoid growths, some attacking both the vegetative and fructifying organs, while others the fructifying organs only. Besides these vegetable pests insects such as *wheat midge* and *locusts* sometimes do great harm. Stormy winds, frost and hail also damage it by lodging.

VARIETIES—The varieties generally sown are *Tunrwa* (bearded or awned) and *murua* (beardless or not awned). Both of them have two sub-varieties under each, namely, *white* and *red*. The Murua seed is white in appearance and more healthy than Tunrwa but for ease of grinding and purpose of food the latter is far better, although there is very little difference in price in the market.

REAPING—Reaping begins in March and is in full swing in April. The crop ripens within 4 months or 4½ months on an average from the time of sowing. One acre can be reaped by 12 to 15 men in a day, the same men carrying them to the stack-yard when the latter is within halfmile of the field.

THRASHING.—The practice varies according to the purpose for which the straw will be required. If required for thatching, the grain is separated by beating the ears with wooden hammers and the straw is tied in bundles. Most commonly four oxen are employed to tread the mass, by which the grains are separated from the straw. Such straw can only be used for fodder. The process of *winnowing* is as crude as ever. The mixture of grains and small bits of straw is poured out, the heavier

grains falling straight to the ground and the lighter bits of straw blown to distance by the force of the wind.

AVERAGE OUTTURN PER ACRE.—On a first class clay land cultivated on the bare fallow system, the outturn hardly exceeds 21 maunds or 1680 lbs. of grain and 24 to 30 maunds of fodder per acre. Speaking generally farmers very seldom find all circumstances favourable and the average yield, therefore, of the whole country may be put down at 15 to 16½ maunds of grains per acre.

Cattle Disease.

CATTLE Disease is reported to have broken out in many parts of India. Under this name is included a number of diseases which effect great many animals simultaneously. A very common though not very fatal one is that which affects the hoofs and mouths of cattle, laming and temporarily disabling them and in case of milch-cows seriously interfering with milk secretion. It has got different names in different districts of each province but all of them seem to be formed from the vernacular word which means hoof. It attacks many animals simultaneously but seldom proves fatal especially if properly attended to. Lameness with eruptions between the hoofs and on the mucous membrane of the mouth are its diagnostic symptoms; it goes by the means of *khuria* in Bengal.

There is another disease with eruptions appearing on the body accompanied with severe fever and in every way more serious and fatal, which from its resemblance to the small pox in man is called *Guti*, *Basanta* &c. Eruptions all over the body, complete refusal of food, discharge of watery matter from mouth and nostrils followed by dysentery, are the characteristic symptoms of the disease.

It is very common and fatal in Bengal, hundreds of cattle are killed by it every year and when it breaks out in a herd, few escape the attack and the percentage of death very large.

There is a third disease without any eruption on the body which nevertheless is dangerously infectious and proves rapidly fatal. The disease is commonly called *Paschima* in Bengal but like other diseases it has also got various local names. The symptoms are very like those of *guti* but it runs a very rapid course, proving fatal in four days on an average, whereas the duration of *Guti* is on an average eight to nine days.

These are the three very prevalent infectiuos epizootic or contagious cattle-diseases in India, especially Bengal.

The best treatment for all these diseases is preventive, remedial treatment being of very little avail, especially in the latter two. In England when infectious cattle diseases such as Pleuropneumonia, Anthrax, Foot and Mouth disease break out, all cattle owners are required by the Contagious Diseases of Animal's Act to report at once to the authorities, who after inspection order the killing at once of the affected animals and isolation of the rest, the removal of animals from the affected to any healthy farm being at the same time entirely put a stop to. The farmers get a compensation from 30 to 40 per cent. of the value of the animal killed.

Until such a law is passed of which none will question the necessity, we would impress on the mind of our readers and on the provincial Agricultural Departments the following methods :—

Firstly.—Animals already affected should be at once completely isolated and killed, but as the latter step would be very revolting to the Hindus who form the major portion of the population of India, complete isolation is all that we have to be satisfied with. Dog, cat or any other domestic animals should be strictly excluded from the compound, in fact all possible and preventible means of communication stopped.

Secondly.—All animals not actually affected but suspected to have probably caught the contagion should be kept in a separate place quite apart from the affected ones and all the rules of complete isolation observed as in the former. They should be examined once if not twice a day and those developing symptoms of affection at once removed to the affected lot.

Thirdly.—The third lot should be composed of the healthy ones, kept under as strict supervision as the other, and examined at intervals to find out if any there be developing suspicious symptoms and to remove it to the second lot.

These precautions will surely prevent the spread of the disease to the unaffected animals of the farm and also to those of the neighbourhood.

Fourthly.—Animals that succumb should be carefully carted to a distant field and buried at lest three feet deep beyond the reach of dogs and jackals.

Fifthly.—The sheds of affected and suspected cattle should have their floors thoroughly scraped and scrubed, the scrapings &c. burnt, walls white washed and carbolic acid, sulphate of iron and other disinfecting liquid or solid freely used.

Cattle seldom survive attacks from the last two diseases, the remedial treatment for which therfore

is of secondary importance. Various methods of treatment for these diseases have been suggested and are practised, but it is very doubtful whether the percentage of death is appreciably diminished thereby. In the first of these diseases which if properly attended to seldom proves fatal, the eruptions and ulcers in the foot and mouth are liable to treatment. A common method of treatment in Bengal is to keep cows standing in water or soft mud. This method keeping back the flies which aggravate the ulcers, tends to cure them and must be done thoroughly and continuously, if done at all. Where this method is not practicable as in cities and big towns, the ulcers should be carefully washed with a lotion which may consist of :—

(1) Alum (Phatkiri)	...	2 oz. or 1 Chatak.
Water ...	...	2lbs. or 1 Seer.
or (2) Salt ...	...	4 oz. or 2 Chatak.
Water ...	...	2lbs. or 1 Seer.

and then painted with an ointment of :—

Sulphate of Coppor	...	2 oz. or 1 Chatak.
Treacle ...	...	8 oz. or 4 Chatak.

If through carelessness maggots form in the ulcers, they should be carefully removed, the swollen parts poulticed with bran, and powdered charcoal, camphor, oil of turpentine frequently applied. Even frequent application of kerosine oil with poultice twice or thrice a day has been known to kill the maggots and heal the ulcers. Few cattle will be lost from this disease if these directions be carefully followed.

It is generally believed that the first disease, *viz.*, the one which affects the foot and mouth, is the same as *Foot and Mouth Disease* in England and the third, *viz.*, that which is generally called *Paschima* in Bengal and probably *Pedda Mossa Rogum* (disease) in Telugu is the same as *Cattle Disease* in England or *Reinderpest* in Germany. It is still more doubtful what is the English representative of the disease called in Bengal *Guti* or *Basanta*. At all events, this is certain that it has nothing to do with *Cow pox* as the local names signify.

In the absence of any reliable statistics and accurate scientific investigation on the subject, it is unsafe to hazard any very decided opinion on the similarity of Indian and English epizootic cattle diseases. For instance, no where do we find any mention of *Anthrax*—a very fatal disease running a very rapid course,—among Indian cattle, although it is not uncommon among horses under the name of *Ludhiana fever*. Similarly *Pleuro-pneumonia*, also a very fatal and contagious disease making great havocs among English cattle now and again, is reported to have broken out sometime ago in Madras and caused great loss; but nothing decided is known to assert authoritatively that the Madras plague was really one of Pleuropneumonia. The absence of statistics as we have already remarked is a great desideratum in this as in all other branches of agriculture. And in the absence of such a statistics it is impossible to show the actual loss by cattle plagues in whole India. These are as constant in their ravages amongst cattle as cholera and small pox amongst human beings. The loss to the agricultural community must be enormous and its effect "must be felt in checking the increase of cultivation which would otherwise progress even more rapidly than at present, thus lowering the public revenue. In the interests of the State it is imperative that efficient measures be taken to grapple with this evil."

It is only the Administration that can sufficiently cope with this evil and adopt efficient measures to check it: private means would be quite unequal to the task. The preventive measures that we have suggested above should be adopted and a law passed in the lines of the "Contagious Diseases of Animals' Act" of England. We shall recur to this subject again in our future issue.

Sterility of Soils.

ORDINARILY soils contain *most* of the elements of plant food in tolerably abundant quantity and no fear need be entertained of their exhaustion. The only three things in which soils are generally deficient are (1) nitrogen (2) phosphoric acid and (3) potash; and hence it is that these constituents of the soils require more attention and study from the agriculturists than the others. For plant growth, other elements may be as much necessary as these three, but the former being abundantly supplied in all soils is of only subsidiary importance to the farmer. Air is as much a part of human food as rice, bread or meat and, as we cannot live without it for a moment, is in that sense of more importance than the latter; but having an inexhaustible store of it, we only care for our bread and meat. It is just the same with plants. For all practical purposes, most soils contain an almost inexhaustible supply of all the elements of plant food, excepting the three constituents named above. You can crop the landyear after year, and, provided nitrogen, potash

and phosphoric acid be returned to the soil, you can be practically sure of your crop. Of course it goes without saying that when you raise a crop and cart it away from the field, you diminish the store of plant food in the land, and if this process be continued indefinitely the store will get thoroughly exhausted. But this state of thorough exhaustion is never allowed to be brought about. Nitrogen, potash and phosphoric acid which are usually present in very small quantity run through first and even if the other food constituents be in abundance, no crop will grow and the land will be absolutely sterile.

It is the *minimum of all the food constituents of plants* and *not the maximum of any one of them* that rules the sterility of soils.

We believe we have made it clear, that one cause of sterility of soils is the absence in the soil of one or more of the elements of plant food in sufficient quantity and that the elements the absence of which generally makes the land sterile are (1) *Nitrogen,* (2) *Potash* and (3) *Phosphoric acid.* All plants, at least all agricultural ones, feed on the same elements but the amount and the state of combination in which each element is taken, are different for different class of plants. Animals just like plants, all live on the same elements but all do not use the same amount nor the same state of combination of the various elements. Men, for instance, live on both vegetable and animal foods, cows sheep and goat on vegetables alone, tiger leopards on animal food alone, pigs on almost anything and everything, similarly one class of plants, say the corn family (wheat rice, millet &c), will require more of one element in a certain state of combination than another class, say the pulse family (peas, beans, grams &c.) When we grow wheat after wheat or rice after rice on the same field without any manure for a long time, the elements existing in particular state of combination of which the particular class of plant is fond, get used up and the other elements of plant food, be they ever so abundant, will be of no avail to the plant for which the land will be absolutely barren. All the elements may be present there, but one or more of them being either wholly used up which is very seldom the case, or present only in insufficient quantity and in an unavailable form, the land will be sterile for that class of plants. But the same land, for reasons given above, need not necessarily be barren to another class of plants. The state of combination and the quantity in which the elements are present, although found unable to support the first class of plants, may be quite able to grow the second and perfectly sterile for that class. Of course when there is a total absence or exhaustion of one element, the land becomes absolutely barren for all plants, but this is very seldom the case.

One very notable example of the sterility of soils for one class of plants while keeping perfectly fertile for another, is afforded by British *Red clover.* This plant when grown even once in every four years for sometime, makes the land on which it is grown perfectly barren for it or, to use an English agricultural expression, *Cloversick.* The same land will however grow a very good crop of wheat for which it will be perfectly fertile. This we hope will give our readers the clue to keeping their land fertile and unexhausted for a long time and convince them of one of the various reasons of cropping a land with different staples in succession, or, in other words, of rotation of crops, instead of the same staple being put in year after year. Having made this point clear we proceed to notice the next point, that is, the second cause of the sterility of soils.

The presence of excess of soluble salts in soils. It will perhaps surprize some of our readers to learn that the average percentage by weight of soluble salts in fertile soils is seldom over 0·5 or ½, and that if the percentage exceeds 1·5 to 2, the excess of soluble salts serves as a poison and makes the land perfectly barren. If, for instance, you take one seer or 2 lbs of soil from a fertile peace of land and shake it up well with distilled water, you will find that hardly half a tollah, that is, one-fifth of an ounce of the soil will be taken in solution. As plants can only feed on soluble salts, the small percentage of the latter present in all fertile soils seems at first sight ridiculously small for the requirement of our ordinary crops. But this is more apparent than real, since if we remember that the total weight of the soil of an acre (3 bighas in Bengal) of land, 9 inches deep, beyond which the root of agricultural plants hardly reach, is on an average 3,000,000 lbs. ½ per cent. of which gives 15,000 lbs., a quantity which is more than sufficient to provide all the cinereal elements of 50 crops of wheat or as many crops of rice.

From an analysis of a few samples of sterile (usar) or *reh* soils of N. W. Provinces, we found that these samples at any rate contained all the necessary elements of plant food though some in a very limited quantity, and, therefore, the sterility of these soils was not due to any chemical defect. The amount of soluble salts present, was rather large and the sterility, according to Prof. E. Kinch, an authority on Agricultural Chemistry, was probably owing to other causes than chemical along with rather excess of saline matters.

Sterility of soils is sometimes due to the presence of poisonous matters, as for instance, iron in the form of ferrous salts, or too much acid, or lime and

magnesia in caustic form. Iron in the form of ferric salts is perfectly inoccuous but these have atendency to sink down and collect in the subsoil in reduced or ferrous form. When the roots of plants reach the subsoil and come in contact with these *ferrous* salts, these latter act prejudicially and kill them. The sterility of water-logged lands and reclamied *bogs* and *morasses* are owing generally to this cause. A fourth and not unfrequent cause of sterility is the absence of suitable physical condition in the soil. The power of soils to absorb and retain moisture, suitable temperature, proper consistency and state of division—these and various other physical conditions must be fulfilled before the land could be fertile. A land containing all the essential elements of plant food and fertile so far as chemical analysis goes, is not unfrequently found to be barren, the barrenness not unlikely due to the absence of proper physical conditions. For instance, a land otherwise fertile may prove incapable of producing any crop owing to its want of retentive power for water, its water-logged condition or unfavourably cold temperature. Hence it is that chemical analyses though generally a very reliable guide, are not by themselves always sufficient to pronounce a judgment on the fertility or otherwise of a soil, though indirectly they give us a clue for the probable determination of other conditions which are beyond the reach of chemical analyses. For instance, the the analysis of usar or barren soil of the N. W. Provinces to which we had occassion to refer above, showed that the percentage of sand was very high that there was almost total absence of organic matter; and it is very reasonable to infer from these two data, that the soil in question can scarcely have any retentive power for water to which sterility must largely be due.

We have thus shown that the sterility of soils is due to:—

(1) Total or, as is more general, partial absence of one or more essential elements of plant food, viz., *nitrogen*, *phosphoric acid* and *potash* in proper state of combination;

(2) Presence of excess of soluble salts;

(3) Presence of poisonous matters as *ferrous salts*, too much *acid*, caustic *magnesia* &c.; and

(4) Absence of suitable physical conditions.

Experiment with a Steam Thresher for Wheat in Bombay.

MUCH attention has been directed of late to the increasing export of Indian wheat, and to the reasons why wheat from America, Russia and elsewhere though produced at a comparatively high cost, is yet able to maintain its place in the English and other European markets. The Bombay Chamber of Commerce has pointed out that Indian wheat does not secure a price and a demand apportioned to its undoubted intrinsic merit.

First, because care is not taken to keep the hard and soft, the white and red varieties distinct.

Secondly, because export samples contain an injurious and excessive admixture of small and shrivelled grains of seeds other than wheat and of dirt and pebbles.

The Chamber attributes the first named objection to carelessness on the part of the producer in selecting his seed, and though I am ready to admit that there is want of care and attention to this important matter, I am convinced that the admixture is principally due to causes which are beyond control, namely, to the influences of season, climate and soil. A heavy fall of rain after the crop has made its first start is sufficient alone to cause a large admixture of soft grains in the produce of the best and purest hard seed. How far soil and climate affect the consistency of the grain, and how far these together with season influence the colour, are subjects for investigation, because they are little understood.

The second class of objections is, I think, remediable. An admixture of hard pebbles, of oilseeds, and of small grains must seriously depreciate any sample, but under the existing methods of preparing wheat for the market is unavoidable. When wheat is pulled the field-earth adheres to the roots, and though the ryot may attempt to diminish the amount, by beating it out before the crop is thrown on the threshing floor, he cannot separate it entirely. The bullocks which tread out the grain must work up pebbles and earth from the threshing floor, and though his patience in winnowing and rewinnowing by hand is remarkable, the ryot cannot produce a clean sample. The merchant finding that he is unable to insist on absolutely pure wheat, is compelled to mit a percentage of impurities. However low this percentage is fixed, a certain door to dishonesty is opened. The middleman cleans down wheat purchases from the ryot, sufficiently to pass muster. If perchance he is fortunate enough to buy a sample containing less than the admissible percentage, it is hard to believe that he would be honest enough not to raise the percentage as far

as he can. There is indeed abundant evidence that his honesty cannot resist the temptation.

Clearly then improvement in preparing the produce for the market is urgently needed, and I believe that the experiment lately made warrants my conviction that the utilization of steam machinery will both directly and indirectly effect the desired improvement.

But how can steam machinery be placed within the reach of the producer? The ryot is very averse to innovation. He is not rich enough to provide himself with expensive machinery. Even if he were, he could not work it or keep it in repair. This last objection is to my mind fatal to the introduction of hand or bullock power machines, for these cannot afford skilled supervision. In the full recognition of these facts, Messrs. Marshall and Sons of Gainsborough have through their agents, Messrs. Balmer Lawrie and Co. of Calcutta, put to a practical test my contention that it will pay to import steam machinery and to work it for hire. The conditions of the country must be thoroughly understood before such a venture can be made on a large scale, and this year it has been confined to the experimental trial of one machine, imported for exhibition in Calcutta in 1883. The precaution was taken to send a trained hand to work it, and a qualified engineer to take note of any modifications, which local conditions may suggest. The trial brought out in a very extraordinary manner the stubborn incredulity of the ryot and at the same time his ingenuity in inventing objections to innovation. I may be excused for prolixity, for the trial has given ample proof of the extreme difficulties in the way of any attempt to improve existing institutions and will be instructive to those who like myself are entrusted with schemes of improvement. The machine consists of a thresher, worked by a small engine, each moveable along a fair road by three pairs of ordinary bullock. The thresher is priced at £ 125 in England. The engine costs £ 190. The thresher is provided with a special drum for threshing rice, and can no doubt clean *ragi* and similar grains. The corn is separated into firsts (absolutely pure full sized grain,) seconds (small and broken grains) and tailings. These last contian a large admixture of chaff with good and bad grains and are always put through the machine a second time. The straw is separated from the cavings, consisting of broken straw awns &c. and the chaff, while the dirt is collected away from the grain and straw under the body of the thresher. In this, such impurities as seeds of mustard and linseed must find their way. If with the wheat however, ripe, grains of safflower (an oilseed generally sown in rows in wheat fields in the Bombay Presidency) are mixed, neither this nor any other machine can separate them. This seed is similar in size and specific gravity to the grain of wheat and if ripe will fall into the bag which receives the best grain. Fortunately safflower ripens later than wheat and if soft it is crushed and eliminated.

The machine is provided with a patent drum protector, so that the feeder runs no risk of injury Feeding is very simple work. A man picked up in any village can feed efficiently after a few hours teaching and practice.

In the first trial made, the machine turned out one ton of good grains (firsts) per hour, and if proper arrangements for carrying the wheat to the machine are made this pace can be kept up without difficulty. The proportion of the various products as deduced from a careful test was as follows:—

Grain.		*Straw.*	
Firsts ...	92·2. per cent	Long straw...	30. per cent.
Seconds..	5·8. „	Cavings ...	40. „
Tailings ..	·3 „	Chaff ...	30. „

Grain found in the straw amounted to 1·7 per cent. Of this none was found with the chaff, only 3 tolas with the short straw and this was accidental and due to spilling from the sheaves or otherwise. The proportion in the long straw, is far less than is lost in the repeated operations of the native method and after all may be well spared to improve the fodder. It is insignificant when compared with the amount eaten by the cattle, where as is not uncommon they are not muzzled while treading out the corn.

The percentage of tailings is exclusive of the intermingted chaffs. Samples were sub-mitted to the Chamber of Commerce. A sub-committee of experts, though declining to express an opinion as to the relative value of steam threshed wheat and wheat trodden out by cattle, in the absence of samples prepared in each way of the same variety and quality, reported that the samples "are undoubtedly clean and in that respect as also their "freedom from damaged grains, meet with the strong "approval of the committee."

As regards fuel, the engine is adapted to burn straw and the makers estimate that one tenth of the straw only is consumed. This may be the case where the straw is long, but the proportion would be much larger where as here the wheat is reaped dead ripe and the straw is stunted and nearly leafless Coal was however used in the present experiment.

I now turn to the narrative of the trial. I met the machine at Niphad on the 11th March. It was already set in position in the stackyard of a ryot named Vithoba, who had a goodly stack of wheat. Steam was got up and the machinery was put into motion. No threshing was done that day as it was late and the working parts required oiling and examination. The confined space in the stackyard presented a difficulty and it may as well be at once admitted that the farmers will have to bring their wheat to the machine and take back the straw to the stack-yard, unless this yard is unusually large. This can very easily be done by carting the crop direct to the machine placed in an open spot and pitching the sheaves from the cart to the machine. The empty cart can then collect and carry the straw to the stack-yard and another full cart be brought alongside. In the present case however the wheat had been stacked before the arrival of the thresher.

On the following morning in the presence of the Collector and other officers, European and native, including all the Mamledars of the Nasik District, the trial began. Very soon Mr. Vithoba was seized with alarm. He expected to see the straw come out softened and crushed as it comes from the native threshing floor. He declared at once that he was a ruined man, that however good the grain might be, he could not afford to lose the straw, the only fodder he had for his cattle. This point was at once considered. It had been foreseen. The long straw came out unbroken, all the awns of the wheat were collected with broken straw in the cavings, and the chaff was hard and stiff. I was very ready to agree that it might cause cattle injury to eat the cavings and chaff, but urged that it would be very easy to soften the fodder by a partial treading. The ingenious ryot was ready with a reply and it was that the cattle cannot tread the straw and soften it, without the help of the trituration of the grain. I did ask if any one had ever tried to tread the straw without the grain

No one had and Vithoba was pacified by being promised compensation if his opinion proved correct. The trial went on. Vithoba and others inspected the grain as it fell into the various bags. I pointed out how well the diseased and small grains were separated from the good grain. "That "is all very well," said Vithoba, "but the good grain "cannot weigh as much as the good and bad to-"gether and why should I reduce the amount of my "produce?" At the same moment the village grain dealer said "Ah! this is good for the trade." Vithoba assured that the price obtained for the good clean grain would far more than recoup such loss. With reassurances that this would be a point for arbitration in considering whether, if any, compensation should be given, the trial went on. From time to time further objections were made and met. I can only enumerate these.

1. That the grain must become heated and would therefore be useless for seed.

2. That the grain was so broken that it would fetch a very low price.

3. That no ryot possesses bags to hold the threshed grain.

4. That the loss of grain going over with the straw cavings and chaff was very great.

5. That grain pits would no longer be useful and the money expended on them would be lost.

Briefly, the answers given were that in many countries wheat is threshed by steam and no injury to the germinating powers ever experienced. Vithoba was advised to put a few grains into a pot and water them and see how many failed to germinate.

2. That the broken grains were not one in a thousand. The wheat dealer present declared this objection groundless. The final decision may be taken to be the opinion of the Chamber of Commerce who in Committee remarked on the "freedom from damage." The brittleness of the hard wheats of this district makes a certain amount of breakage unavoidable. It would be imperceptible with soft wheats, or wheat not cut dead ripe. As the machine went on, the percentage of broken grains became very much less. But the Committee of the Chamber saw a sample in which the percentage was comparatively high.

3. The objection as to the inability of the ryot to provide bags is serious to him, who has no cash, but it was urged that he could sell grain and bags together. This apparently foolish objection may cause difficulty, unless the traders take to the innovation I believe they will, especially if the merchants can insist on the absence of impurities and the temptation to tamper with the sample is removed.

4. The test trial showed no grain in chaff or cavings and only 1·2 per cent in the long straw. This objection has already been met.

5. The best answer as to the loss of capital sunk in grain pits was that given by the Reverend Dr. Fairbank, *viz.*, that where he can get his wheat threshed by steam and sent off at once to market, the ryot would be wiser to pocket his money and keep his wheat away from the contamination of the pits.

These objections were not hard to meet, but they and others perhaps, not expressed, weighed in the mind of the conservative ryot and the opposition to the machine became general. Vithoba begged that the machine should be stopped. Once it was stop-

ped to adjust a belt. He asked me in an undertone whether anything had broken, I said no, and he replied "what a pity." At another time he asked me with wonder what had induced me to disturb their minds by bringing this machine, what benefit I could expect and why on earth I took so much unasked for and unappreciated trouble.

Work was carried out in a desultory way during the day. In the afternoon I collected the crowds present and explained the necessity of a cleaner sample, if the ryot wants a better and surer market for his wheat. I explained that a straw bruiser would remove the undoubted objection on the score of the unfitness of the straw for fodder, that one would be brought out next season. I tried to impress the following advantages of steam threshing.

1. That cost of carriage is reduced because dirt and other impurities are eliminated.

2. That the season's wheat can be put into the market as new wheat, almost as soon as reaping is completed. New wheat always fetches a higher price than old wheat.

3. That the inevitable loss which must result from pitting or otherwise preserving wheat would be avoided.

4. That the loss from wastage in transit and breakage of bulk at the Port, estimated at 3 annas by the Chamber of Commerce for every maund of 82 lbs. would be saved.

5. That the producer would be able to secure to himself much of the profit which now goes into the pocket of the middleman.

6. And lastly but most important of all that the ryots' cattle would be freed for field work, which under present conditions is neglected but which would repay him manyfold.

The assembly assented to the statements made and them I asked for opinions. The first was that the ryot cannot secure steam threshing machinery for use. I admitted that neither he nor village communities can be expected for some years to purchase the apparatus and that the makers of the machine will work for hire. Then came out the grand objection that the outturn from the machine was less than that from the bullock trodden floor. A jagirdar asked that this point should be cleared up, and begged that a thousand sheaves each should be counted out to the machine and to bullocks, and the grain weighed. I objected on the ground that it would take too long to make this trial, and suggested an amendment,—*viz.*, that 50 or 100 sheaves should be put into the machine, after it had been thoroughly cleaned, that all the straw should be received on cloths spread out and that the grain from all parts should be carefully beaten out by hand. This was done and the results are given above. At the same time 50 sheaves were counted out to be trodden by bullocks, in order to compare the time taken with that required by the thresher and to compare the quality of the outturn. Next day it was shown that the cattle took 3 hours to do work which occupied the machine 3 minutes. But unfortunately either because the sheaves so given were larger than those put into the machine or because there was dishonest addition of other sheaves on the threshing floor, and I have reason to suspect dishonesty, the outturn was slightly greater. No intelligent observer could suppose that this could prove that the machine did not account for all the grain put into it, but the result was melancholy as will be seen.

Next morning a 3 hour trial was made in order to fix the charge to be made for threshing. During this trial the other experiments were going on *e. g.* the hand cleaning of the straw &c., threshed from the 50 sheaves and the testing of the assertion whether cattle can soften the straw, without the grain. The straw from the 50 sheaves was in half an hour (long straw cavings and chaff all mixed) trodden and in the opinion of all unbiassed judges was quite as fit for fodder, as that trodden with the grain. It was not so soft, simply because more treading is required to beat out all the grain, but it was quite soft enough to present any danger from sharp awns and stalks, sticking in the gullet or palate of the cattle. The 3 hour trial showed that taking into account the interest on capital, depreciation and cost of working and fuel, the machine under the following conditions can work at the rate of one anna per maund of 82 lbs. of firsts (seconds and tailings neglected.) The conditions are that the engine finds work all the year round in sawing wood, raising water and threshing and that the thresher finds three months work each in threshing rice and wheat. Now the cost to the ryot is as I have most carefully estimated at the very least three annas per maund and another 3 annas are saved from the fact that re-cleaning at the Port is rendered unnecessary,

Now came the question whether Vithoba was to be compensated for his loss; nearly 2 tons of his wheat had been cleaned and bagged gratis. True his threshing floor was upside down. I dare it cost him Rs 5 in labor to put it to rights. I named my arbitrators, but though I did all I could to induce Vithoba to name his (and the whole village was with him) he let me and my arbitrators get into the train to go away. I may mention that I had nominated Dr. Fairbank, who has had 30 years experience of the district adjoining Nasik and who is in no way connected with Government. He is an agriculturist of repute and local experience, and one

of the best friends the ryot has. The other was a Patel of influence and experience, whom I had never seen before but who had shown much intelligence and interest in the experimental trial.

The next day, however, after my departure Vithoba named his men probably because he felt that he could count on the temporary triumph of conservatism and ignorance. The Punch awarded Rs 10 as compensation, on the ground that the grain "*produced by the machine was less by four seers per maund of 64 seers than that produced "by the native process.*" Vithoba was not satisfied. He claimed Rs. 500. The machine visited Niphad a second time later on and its working then will, I think, be sufficient to convince even Vithoba himself that he had neither injury nor insult to complain of. There were present however men of a different stamp. The mamledars and others were convinced of the value of the machine and of the profit to be got from it. They tried manfully to induce other farmers to see the profit and give their wheat to be threshed. They went so far as to offer to buy up all the wheat in the village at Rs. 5 above the market value and run all risk of loss themselves. But they failed. They even offered to let a committee of the villagers fix the price of the wheat and promised to pay it. Their exertions were vain, though very praiseworthy and a strong evidence of the success of the experiment. I decided to try the machine elsewhere, and it was moved off. Vithoba showed much delight and rushing forward shouted to me "See how ready I am to help "Government" and joined with the labourers taking the thresher from his stackyard.

More precautions were taken regarding the second trial. The Collector of Ahmednagar was asked if he could guarantee 7 days work at any convenient Railway station in the adjoining Taluka Kopergaon. He was informed of the merits and demerits of the machine as they appeared to the men of Niphad and after explaining all to the ryots of Puntamba, a list of names was sent in with the signature of those ready to utilize the machine. I succeeded in meeting the machine at Puntamba. The ryots showed much interest. Before doing anything else I explained that the straw was not converted at once into ' bhus" and required to be trodden soft. A preliminary trial was made in the evening with wheat belonging to a Brahman. The machine affords special attractions to those of this class who are not pure cultivators and who find the labour market very dear in busy seasons. A few hundred sheaves were put through the machine, which was in an open place. The Brahman had no space in the stackyard, where his wheat was placed. It was not his own yard, but he had been allowed by the owner to use a part of it. It was found that the machine was much delayed by the slow supply of wheat and more labourers could not be induced to carry except at absurd rates of wages. The Brahman had no harvest cart and so a large stack-yard nearby was selected for working next day. The owner had signed the invitation for the machine. He helped to bring the thresher and engine alongside his large stack and appeared very well pleased that his turn had come. He and all the rest had seen the trial that after-noon when the same objections were raised as were raised at Niphad, though the people seemed to think that the explanations were satisfactory. All preparations were made for the work to begin very early next day. The Engineer and I were on the grounds before daybreak to be sure that the fireman had got up steam. The ryots straggled in, but at last there were enough to begin with.

There were no bags, no rakes to keep the straw from clogging the machine, no billhooks to cut the bands, no owner with his men to stack the straw. The conditions were that the only labour to be provided by the owner was for stacking the straw. Twelve men were employed by the machine and were ready. The mamledar was much perplexed. He had given orders for bags and now started off to see why they had not been obeyed. He had no suspicion of any anticipated opposition. I tried to get rakes and billhooks from the numerous stackyards around. I could not find one, though I know that there were hundreds close by. Each ryot in his yard said that he had none. Now it was clear enough that there had arisen during the night an orgainzed opposition. This was still clearer when a man came up and said the wheat near which the machine was placed was his and that he would not allow it to be touched. He explained that his father, an old man, had been forced into signing the agreement and that he had been no party to it. The old man was found. He was as wary an old fellow as I have ever seen, and the blank expression of ignorance and bewilderment which he assumed was even under the circumstances excessively amusing.

The mamledar resorted to entreaty and argument and at last this second Vithoba was pacified and quickly produced rakes and billhooks. But he could not produce men to stack the straw. He said he could not find any. Work was begun and the machine worked very well indeed. The wheat was thrown from the stack direct and the outturn was very satisfactory. I began to hope. But soon an old villager, evidently a man of light and leading in the eyes of his fellow villagers appeared. He wanted to see everything. I explained all to

him, and took him to see the grain in the various bags. But he suddenly turned round and said it was a scheme to ruin the village. He first argued that the broken grains would make the wheat unsaleable. A rich trador, who had been watching the work then came up and said that he would give Rs. 75 per. candy for the wheat, *i. e.*, Rs. 10 above the maket value of the place. " Very well said," ramarked the man of light and leading "and when " the saheb goes you won't give an anna." The mamledar offered to stand surety. " You are not " a millionare was the reply. You can't " stand surety for the whole country. " Then the Engineer (Mr. Gallon C. E.) offered to buy up all the wheat threshed by the machine at Rs. 75 per. candy. The old man was a little beaten and he walked into the crowd. I saw that there was no hope. Two Brahmans however begged to have their wheat threshed. One, the owner of the grains cleaned the day before, was very anxious. But he could not get permission from the owner of the stack-yard. He offered to pay for the use of the yard. But he was laughed at. The other Brahman's stackyard was a mile off and the road to it was dreadfully bad. And again I had to take the machine away. This time we made Vithoba pay for the little work done. I estimated the amount and asked for Rs 4. But he would not agree and he deliberately measured it all with his own hand in a measure holding 6 lbs and eventually had to pay Rs 4-8. In measuring he had to pile the grain on ragged cloths and a great deal was spilt throughs the holes and on the side, and yet these men complained of the loss of grain with the straw. A novol objection was raised here. The black earth under the machine was examined and a trace of broken powdered grain was found. A mountain of objection was at once raised. "Look how the wheat is lost." I carefully scooped up a little of this black dirt and found the percentage of grain so infinitesimally small that a calculation would not be worth the time and trouble. Vithoba did not mix the good and bad grain together, as I fully expected he would. I verily believe he would have done so, if a trader had not said before us and in his hearing that he would. It is very possible he did mix not only the small grain with the good, but all the black earths collected under the machine, which by the way was enormous in proportion to the wheat. Vithoba had pulled his crop and ounces of earth adhered to every plant.

I could not go on with the machine to its next trial but the results were more satisfactory. A native chief, the Vinchurkar, who had seen the trial at Niphad gave the machine work in the Nasik District again. The mamledar of Niphad also succeeded in collecting a fair amount. Here 10,000 sheaves were threshed in 18 hours giving 142 bags of clean grain. The weights have not been reported but I fancy the bags held about 200 lbs. All that that the mamledar had collected was put up to auctions and fetched Rs. 6 per candy more than the local price for wheat threshed in the usual way, though it was "inferior in quality and somewhat discoloured." The machine was then taken back by road to Niphad where the energetic mamledar had succeeded in collecting 25,000 sheaves which were threshed in 20 hours. It was found too hot to work between 11 and 3 P M, not for the engineer but for the coolies. Thence the machine went to Kherwadi on the railway where 148 bags were turned out. At each place crowds visited the the machine, but not one ryot till the very end spontaneously offered his wheat. The mamledar was obliged to leave the machine to buy ponies for Afghanistan and Mr. Gallon has gone to Jabbalpur. I have just received a note from him which shows that the intelligence of the Central Provinces is not greater than that of Bombay. Since writing the above, I have learnt that H. H. The Thakur Saheb of Morvi in Kattywar has brought out a thresher to be worked by steam and is now instituting trials. I am not discouraged and intend to repeat the trials next year. The machine does the work it professes to do and it is work which must be done. Though I anticipate uphill work, the steam wheat thresher will become as popular as the steam cotton gins, whieh have in some places completely ousted the hand gin.

E. O. OZANNE, C. S., M. R. A. C.

Director of Agriculture,

Bombay.

Poultry includes ducks, drakes, cocks, hens, and pigeons There are about 52 million fowls in Fance and about 14 millions in Ireland. The approximate production of eggs per annum in France is officially given as nearly 1800 millions or the large average of 91 per laying hen. In 1882 England imported 800 million eggs of which one half came form France, her total exports being 600 millions. The average consumption of eggs in France would be about 40 per head per annum. if the whole of the number laid and imported could be eaten. As this is impossible, the average consumtion per head per aunum may be taken at 20.

Agricultural statistics of France gives the average number as 91 eggs per laying hen per annum but the number varies from 133 to 62. After the fourth year, the productive power of hens rapidly decreases and in France hens are rarely kept after their fifth year.

The fowl-house must be appropriately furnished, the run must be laid out as a miniature garden and farm, with trees, shrubs, corn, grass and green stuffs. The fowl must always have access to grass which they eat almost continually. They must have a sandy spot available "*faire poudrette*" (to evacuate). The run should be turned over every month, especially during the summer to prevent unhealthy smells from the excretions. Grains should be sown and fowls have an opportunity of scratching up germinating corn of which they are excessively fond.

The greatest number of heads of poultry that can be kept profitably on a single farm varies from 200 to 300. If greater number is kept the ground becomes poisoned and it is found impossible to rear chickens. The majority of breeders adopt the plan of placing 25 fowl's eggs under a young turkey hen. When it is desired that the turkey hen shall commence to sit, she is placed in a suitable box almost entirely covered by a board and some *dummy eggs* are put under her. She gets soon reconciled to her confinement and takes to the dummy eggs which are then removed and 25 fowl's eggs are placed beneath her. She is taken off the eggs once a day to feed.

When the chicks are hatched, they are removed from under her to be either sold or sent off at once, or to be brought up by another turkey hen which is perhaps an indifferent sitter and which instead of sitting has from 80 to 100 chicks given her to bring up. The hen turkey which hatched out the chicks is then provided with 25 more eggs and the process is carried on six, seven, or eight times in succession.

In a certain fowl farm in France the stock consists of 180 laying hens, and 12 cocks with 20 ducks and 10 turkeys in addition. In 1879, 13,341 eggs were laid, while 40 adult cocks and hens, 97 ducks, 25 turkeys, and 171 chickens were killed for the table.

Every peasant proprietor in France with perhaps two or three acres of land, keeps fowls, the produce from which is collected by dealers who scour the country.

Bombay peasant farmers enjoy security of tenure, because the land law of the province assures to every holder under Government a proprietory right in his holding as long as he pays his rent. To prevent apprehension on the score of periodic increase, it has been lately ruled that the enhancement should not on future revisions exceed a certain fixed percentage. The revenue survey which has been going on for the last half a century or there about is expected to be finished in eight years more. The state rent should not be enhanced owing to increased value of land due to improvement made by the holder. Suspensions or remissions of revenue are granted on any serious failure of the harvest and the eviction of the state tenant because he cannot pay his rent has been absolutely forbidden. With regard to higher cultivation, by which is hoped that the land may be enabled to support a larger population, that wealth may be brought into the country, the valuable produce may supersede the present glut of coarse grain. Here the peasant farmers are called upon to do something novel, and costly, a difficulty in which he stands in need of advice, information, and benefit of experiments.

To meet these needs, a Department of Agriculture was created two years ago in Bombay and "placed under Mr. Ozanne who has passed with distinction through the course of the Agricultural College at Cirencester." The Chamber of Commerce has been in communication with him for the improvement of the staples of cotton and wheat. This is only the beginning of a much larger operation and the Director of Agricuture will, it is confidently expected, become a channel of communication between the producer and exporter, the peasant farmer and the merchant to the great advantage of both.

It is stated in a pamphlet recently reviewed in the columns of a Bombay contemporary that the stringent measures of forest conservancy applied in the Thana district have irritated the proletariat class almost beyond endurance. Rights of user which they have from time immemorial exercised over forest produce have been taken from them, or curtailed, or regulated almost out of enjoyment. Thus timber for building purposes and for the construction of

agricultural implements, fuel, the twigs used in the preparation of *rab*—the precious ash manure on which the fertilization of the soil for rice cultivation depends—all these which in other days the forest tribes and the village cultivators used to obtain in easy abundance are now to be had only subject to restrictions which the people resent as burdensome, onerous and too heavy to bear.

The Russian trade with England has been decreasing of late years. In 1883 there was imported from Russia into England wheat, flax, hemp, tallow, and wood to the value nearly of 13 millions sterling, while in 1884 the amount had decreased to 8 millions, or a reduction of 40 per cent. With regard to English productions more than 5 million pounds worth had been imported into Russia in 1883, and in the following year the totals showed a decrease of only one-third per cent. Russian protective duties have failed to check the importation of English goods in to the Empire.

The term artificial manure is used by way of contrast to mean all those that are not produced in the farm but have to be bought by the farmers. The two most valuable and expensive of these artificial manures are nitrate of soda and sulphate of ammonia, the former selling at present in England at £ 12 and the latter at £ 15 per ton. A new enterprize in the way of manufacturing artificial manures is reported to have been recently set on foot in Germany.

A German Chemist Herr Winkler, has just patented a scheme for extracting and condensing the ammoniacal gases which are at present wasted during the conversion of coal into coke. It is estimated that from all the different coke ovens at present at work 58,600 tons of ammonia might be produced which by a simple process, could be converted into a most excellent artificial fertilizer.

Here is an example for Indians to imitate. Under peaceful Government in Persia, the Industrial Arts are making rapid strides, two of which deserve special mention. An increasing demand has of late arisen in Europe for Persian enamelled bricks with painted designs; and Ispahan fully meets this demand. There is likewise an European demand for the manufacture of imitation of ancient Russian armour in steel. Europe is also supplied with good deal of brass fancy articles most elaborately carved or engraved in decorative designs. There are three representatives in Ispahan of European commercial houses *viz.*, Zigler & Co., Hotz. & Co., and Muir & Co.

A Madras contemporary tells us that the merchant marines of the world contain at this moment 53,167 vessels of which 44,734 are sailing ships and 8,433 steamers. Of this total number 20,474 or considerably more than one third, belong to Great Britain, the proportion being 15,384 sailing vessels and 5,000 steamers ... ... In the event of hostilities with Russia, British commerce would not suffer to any great extent. War is a great stimulant to trade and one of the indirect consequences of such a conflict would undoubtedly be to give to the wheat trade of India an impulse similar to that which the cotton trade received from the American war.

The preservation of grain in underground pits or *silos* as they are now called by the Continental and American agriculturists, has been known and practised in India for a long time; but the practice preserving green fodder in such pits or *silos* is comparatively of very recent origin. Even as late as three years ago, the practice, if not unknown, used seldom to be resorted to in England. In these days of frequent recurrence of droughts and consequent scarcity of fodder for cattle in India, the question assumes a very great importance. The question of preservation of fodder in *silos* is also recieving good deal of attention in many parts of Australia. We read of the opening of a large *silo* constructed on Beefacre's Estate in south Australia. It consisted of four compartments, each 12 feet long, 12 feet wide and 12 ft. deep, capable of storing 300 tons of *silage*. It cost a little less than £ 300 and is expected to last for at least thirty years. Other less expensive modes have also been tried for which a hole has simply been dug in the ground and the side plastered and the mass of green frodder when throughly pressed and weighted, covered over with sheds of corrugated iron to protect it from rain. The *silage* consisted chiefly of *Lucerne* and *Oats* and was cut by a chaff cutter before being put into the *silo*. The shrinkage was very considerable to begin with but after a week it almost entirely ceased. One of the *silos* was opened after a little over a month and though when first opened the silage had a slightly acid and vinous smell, this seemed to evaporate after short exposure and the cattle ate it greedily. It is said that some cows which had been beginning to get dry, after a few days feeding on *silage*, commenced again to give almost their full quantity of

milk and that the milk, cream and butter were of great richness, the latter being specially good.

INDIAN COTTON TRADE WITH EASTERN AFRICA.—India is a great cotton producing country in the world and steps might be taken by the British Government both in England and India to extend the trade in Indian cotton in all parts of the world which have a demand for the article. At one time a remarkable demand had arisen in Mozambique in favour of Indian cottons. The natives discovered that they were both durable and cheap, and for a time it seemed as if cottons from India were at no distant date to monopolize the market. The Mozambique tariff, levying duty on cotton clothes by weight irrespective of coarseness or fineness of their texture threw a great difficulty in the way of the Indian trade. Inspite of this the trade continued until in 1882, a special tax was placed upon Indian cottons. The Foreign Office interferred and the obnoxious tax was repealed and it might be hoped that the same office might go further and demand a fair treatment for Indian cotton trade.

Cinchona cultivation is gradually coming to the front. The cultivated area in Government plantations in Sikim is 2,296 acres with four and three quarter millons of trees. The nurseries contain nearly half a million seedlings and rooted cuttings The quantity of bark collected last year was only 306,160 lbs. the whole stock available for use being 469, 663 lbs. Of this amount 320, 320 lbs produced 8,464 lbs. of Government febrifuge at a cost of Rs. 10-4-7 per pound and 250 lbs. of superior crystalline febrifuge at a cost of Rs. 15-6-11 per pound. The majority of plants in those plantations are *Cinchona Succirubra* but those are gradually being replaced by *C. Calasaya Legeriana.* The Government plantations in the Nilgiris cover 847 acres, the number of trees is 1,315,454, and the bark collected 183,763 lbs. The only other is at Thandoungyee in British Burma, the plantation being still young. Accurate informations are wanting with regard to the private plantations but so far as is known in Bengal there are 680 acres bearing 1,116,778 plants which yielded 4,800 lbs. of bark. In Maisur there are 23 acres bearing 22,949 plants with a yield of 3,472 lbs. during 1884. In Kurg there are 1,868 arces with 1,494,385 plants.

Some experiments of considerable importance, so far as irrigation is concerned, were made during last year at the agricultural farm at Saidapet, Madras, with the view of ascertaining what quantity of water produces the best returns from soils such as those of the farm. The experiments tended to show that the smaller quantities of water representing a rainfall of 1, 2, and 3 inches respectively produced the best outturn and that much smaller quantity of water than is commonly used by rayats would suffice to produce very good crops.

JUTE MILLS in INDIA.—At the end of the official year 1883-84 there were 21 Jute Mills at work giving daily employment to 47,868 persons including men, women and children. All but two of these mills are in Bengal, one being in Bombay and the other in Vizigapatam. The mills at present at work contain 6139 looms with 112,650 spindles.

In these days of frequent recurrence of droughts which have seriously been engaging the attention of the Government, it is a great relief to find what inestimable benefit canal irrigation can confer on us. The administration of the canal department, N. W. Provinces, for twelve months beginning the 1st April 1883, and ending the 31st March 1884, is an instance to the point. The outlay on construction runs up 8 millions, the gross earnings exceed three quarters of a million and the net profit half a million. The value of the crops grown with canal water in these provinces exceeds six millions sterling. The Agra canal proved the weak point in the system and in a dry season it is often short of water.

Still the area actually supplied with water exceeded the most sanguine expectations of the department as over 170,000 acres were irrigated in the *rabi* alone. The canal made a net profit of 6·47 per cent on the capital outlay, a better return than ever shown before. The Upper Ganges made a profit of 8·45 per cent., the Lower Ganges of 4·45 per cent and the Eastern Jumna of 27·96 per cent. The profit from all the canals in the Province during the year amounted to no less than 7·33 per cent on the total capital expenditure. From these figures it is evident that the canals have attained a great success from a purely financial point of view. The department is more to be congratulated on the fact that it has fed many a mouth that would perhaps have gone unfed and clad many a person that would have gone with scanty clothing.

Notes on Pottery.—In all ages in all countries some sort of pottery has existed. As an industry It has been known from very olden times and as an art it is now treated in European countries where it has been much developed. In England it was Josiah Wedgewood who raised the English pottery from a degraded industry to the dignity of an art and it now occupies a very high position among the polite arts of England. In India it is still in its primitive condition. The ordinary potters here can produce only uncouth illshaped products and it is time we paid some attention to this industry.

We have now potter's wheel and crude system of *throwing*. Both the wheel and the system of *throwing* need much improvement. The wheel must be so constructed that it can be turned with the foot and both the hands may be set at liberty in *throwing*. Proper kiln must be introduced for firing in which heat may be regulated and its waste avoided. Besides the improvement in the wheel and in the kilns we must arrange for turning in order to give smoothness and finish to the crude products of the *thrower*.

Only simple and plain earthenware can be produced by *turning* and *throwing* but for varieties of articles we must have *moulds* which would be best made of *Plaster of Paris*. With the *mould* various kinds of ware can be produced and they can be smoothed by *turning* but these ware will be porous and we must add glazing to our list of improvements before we can expect to get nice things. The *wheel* and the *mould* will give form to the raw material—clay, *turning* a smoothness and finish to the uneven and coarse product of the *wheel* and the *mould*, *kilns* will give firmness to them and *glazes* smooth lustre to the surface, besides removing the porousness of the biscuit.

There are two kinds of *glazes*, transparent and opaque. If the clay is good and the *biscuit* of good color, transparent glazes would be better to apply. Opaque glazes for *biscuit* of impure clay such as we have in India would be preferable. Opaque glazes or *enamels* have given Italian *megolica* and in fact the early progress which the art of pottery made in Europe is due to the discovery of enamels. The *Faience* of France is an enamelled work and we hope in India in the near future, this *enamel* will work wonders in the Indian pottery.

The *wheel*, the *mould*, *the turning*, and the *glazes* all are necessary to produce useful articles; but the human mind ever delights in the beautiful and pottery must rise to the ornamental stage and produce not only serviceable but beautiful articles. *Glazes or enamels* are partly for ornament and partly for use. *Enamels* are specially suited for ornamental work, as on them all sorts of impressions may be produced. The mentallic colours are important materials for beautifying and they may be blended to produce any effect.

NEWS.

Duty will make it impossible to lay down China tea in London at less than three pence a pound.

Owing to the advance of 2*s.* 5*d.* per quarter in England, the Bombay wheat market is quite excited For Bombay No. 1. Rs. 3-12 have been paid for April delivery.

The *Rast Goftar* severely condemns the oppressive measures of Government regarding the forest and abkari laws. It urges that the prohibitive tax on toddy which is used as food by the poor inhabitants should be considerably reduced.

According to the *Economist* the depreciation on Indian Government and railway security has exceeded 10 per cent and Russian stocks are only some 2 per cent below their highest prices in 1884. These figures appear to show that either England over-rates the danger of Anglo-Russian difficulties or that the capitalists abroad who are interested in Russian securities do not, or will not believe that any permanent dispute will arise.

In consequence of the Government resolution to supply all sorts of stores in this country for *Government* use, Messrs T. Orr and sons, of Madras, opened a workshop for the manufacture of levelling and mathematical instruments and procured a skilled mechanic from England to superintend the work. At first numbers of levels and theodolites were sent to the above workshop by the P. W. D. for repair but this was subsequently stopped and the instruments once more sent to the Government workshop. Messrs. T. Orr and

Sons have lately applied to the Local Government on the subject which has issued an order that the firm be entrusted with the execution of the repair works. The Government workshop has, however, not been closed.

The low prices lately obtained for wheat appear to have decided farmers in the U. States to reduce its cultivation. The area in wheat is estimated to be 3,900,000 acres less than in 1884. This would give a yield of 50,000 000 bushels less even with a favourable season, but if the yield of the crop is 15 per cent. worse than that of last year, the total prospective deficiency may be estimated at 100 000,000 bushels. Indian grain will be in so much better demand.

A paper mill is to be started under Parsi management at Puna.

The expected out-turn of the present season's crop of ground nuts in Pondicherry is one-third less, still the market there is just now crammed with the produce. The French steamer Suez takes the first cargo of 30,000 bags for Marseilles.

An examination of the Ceylon oyster banks gives promise of a large pearl fishery in 1885.

The Government of India has decided to sell not more than 54,000 chests of Bengal opium during the Calendar year 1886. The total shipment of tea from China and Japan to great Britain for the season up to the 31st march are 145,192 lbs. from Japan. And season's tea shipped on the 21st March from Canton to London amounted to 12,280 lbs. as against 1,96,479 lbs at the same date last year.

The indigo prospects are very unsatisfactory in Tirhoot, Champarun, Chapra and also Lower Bengal.

The export of sardines (fish) prepared at Mahi has commenced in real earnest. During March last 750 cwts. of tinned sardines, valued at Rs 20,000 were shipped at Tellicherry for Havre.

Boro paddy is being harvested all over Bengal Province. In most of the District rain is badly wanted for the *aus* sowing which is only going on in Dacca, Munsigunge, Noakhally, and Durbhanga. *Cheena* crop is doing well in Behar but is reported to have failed in the Serajgunge sub-division of Pubna. *Moong* and *Cheena* are germinating in Durbhanga and Mozafferpore. *Dalua* paddy of Orissa corresponding to *Boro* of Bengal is being harvested. *Mohwa* flower is being collected in Chotanagpore.

Remission of Duty.—The Government of India have sanctioned the remission of the duties with which instruments executed for the purpose of securing the repayment of loans made, or to be made, under the Agriculturists' Loans Act, 1884, are chargeable.

Agricultural College, Saidapet.—Government have sanctioned an estimate, amounting to Rs 18,370, for completing the upper story of the Agricultural College at Saidapet. A sum of Rs 10,000 will be provided for the work in the final issue of the Provincial budget estimates for 1885-86 by transfer, as proposed by the Director of Public Instruction. The work will probably be completed during the next summer vacation in view of the re-organisation of the school.

EXTRACTS.

ENSILAGE.

The undergound *silo* was excavated in dry gravelly soil with no plastering of any kind, but protected from rain by a light thatched roof supported on forked posts. The dimensions were—

Length	...	...	...	16 feet.
Breadth	...	...	...	11 „
Depth	...	...	...	10 „

with a gradual slope of four inches from top to bottom, the cubic capacity being 1,715 cubic feet.

Work was commenced with the *silo* early in the morning of 28th December last, when the grass in paddock No. 1 was mown with scythes, and as it was cut carted off and deposited in the *silo*. Before packing the green grass a layer of paddy straw was placed at the bottom of the *silo* to keep out any damp, and the grass was then laid on it to a depth of three feet, great care being taken to have the four sides well trampled down by women coolies. As it was determined to try the effect on different descriptions of forage, the following layers were successively packed and trodden down:—*harriali*

grass at the bottom, followed by intermediate layers of chaffed *oats*, *sorghum*, *harriali* grass, chaffed *sorghum*, and *harriali* with a final layer of chaffed *sorghum*. On this was spread a layer of paddy straw three feet thick, and a platform made of the branches of the *hongay* tree was laid on the top and weighted with large rough rubble stones. The work finished was on the 24th January, three days being occupied in weighting &c. The *silo* was opened on the morning of the 16th August, seven months having elapsed since it was closed, and the mass having sunk four feet in the interval. I had no apparatus for forcing down a thermometer to a greater depth than three feet below the surface, but the temperature at that depth was 96°, or 14° higher than that of the air, which was 82° under cover of the shed. When opened the top layer of *sorghum* was a dark-brown color, warm and damp to the touch and containing so much moisture that on pressure a reddish juice exuded at once. The *harriali* grass was not too moist, but was appreciably damp and looked like inferior hay. The vinous smell from both was most overpowering, and at the edges, the *silo* forage was of a different color and emitted a very offensive smell.

A cubic foot of the ensilage was cut out at 1 P. M when it weighed 2 lbs., and on being weighed again three hours after it had lost 3 lbs. by evaporation under a strong wind.

In the course of the afternoon 53 cubic feet were cut out evenly from top to bottom at one of the corners, the contents being so consolidated that it required two men using a sharp spade-shaped steel knife to do it.

The mass weighed 1,099 lbs. per cubic foot, and the stones on being weighed were found to be 31,360 lbs. in weight, giving a pressure of 178 lbs. per square foot.

Some of this forage was at once given to the farm cattle, which ate it with avidity, and it was with one or two exceptions readily eaten by all the horses to which it was offered. On the following day the vinous smell had passed off and was succeeded by an offensive odour which gradually subsided when the forage was loosely spread out, and when I left Kunigal it was being consumed by the farm cattle.

A cubic foot of the harriali grass was brought into Bangalore and is now quite dry and much like inferior hay, except that it retains rather a peculiar smell.

Cattle and horses eat it at once when given them.—*Journal of the Agricultural and Horticultural Society of India*, 1885.

India possesses numerous fibre producing plants, most of which are cultivated by the Ryots and Zemindars. In addition the finest description of Hemp *(Cannabis Indica)* grows wild all over the Himalayas, but, owing to the cost of carriage, none of the fibre is exported to Europe. This objection, however, does not apply to the gigantic creeper under notice, which, to the best of our information, grows to a very considerable extent throughout the Teraie, from Dehra Doon to the Eastetn termination in the direction of Darjeeling. It also grows in the lower and outer range of the Himalayas, and may be in the Sewallics as well. That it will grow and flourish in other parts of India is proved by its presence in abundance in Berar, and it follows that if cultivated, this valuable creeper may be grown everywhere in gardens, and especially in the vast forests in the lower hills, and plains belonging to the Central Province, and also to the Bombay and Madras Presidencies.

Its local or Hindee mane is Maul Dhun. Its Botanical name, according to *Gamble*, "*Bauhinia Vahlii*," (Syn: *Bauhinia racemosa*, Roxb.), and of it, he says :—"Its uses are almost more numerous than those of almost any other forest plant, except the Bamboo. Its large flat leaves are sewn together and used as plates and several leaves pinned together with thorns of the Babor or Bamboo splints produce rough table-cloths. Umbrellas are made with them, as also rain caps. The leaves are strong and flexible, and are largely used for packing purposes in the same way that we use brown packing paper, but unlike it, a very good impromtu drinking cup may be made by a suitable pinning up of the leaf, and as these measure in diameter from inches 9 or 12 to 18, and some Hill men say 24 inches, some idea of the shade producing value of the creeper may be formed. It however sheds these ground leaves when ripening its seed, and comes into new leaf as the shedding process goes on." The seeds, which are long, are contained in a bean-shaped pod, over one foot in length, two to two and a half inches in width, and about half an inch in thickness. The pod is very hard, and ligneous, and bursts open with a loud report. In Berar the seeds are roasted and eaten, hence it is quite possible that the pods, when young, may also be eaten as a vegetable, for as a rule, all the Bean tribes whose seeds are edible, have pods which, in their green and immature state may also be eaten, though when the seeds harden the pod is no longer fit for use, as in the Scarlet runner, Long pod and Windsor beans. We now come to the most valuable portion of the plant namely its inner bark, which yields an abundant supply of fibre. The natives of the place make it into catte tethering ropes of the best

and strongest description. Of the fibre sent many years ago from Berar to Calcutta, Mr. Routledge reported it to be "an excellent strong fibre, Hemp like in character and tough."

The creeper grows to great length, and as in its uncultivated state the fibre has a considerable market value, it stands to reason that under suitable cultivation, the quality of the fibre may be so much improved, as to yield thread of any desired degree of fineness. As the Creeper is a perennial it may, under cultivation, be made to yield fibre of any desired length. But as yet *Maul Dhun*, notwithstanding its great value, has never been systematically cultivated, and as it may be sown grown, and yield its fibre with as much regularity as any other crop, we purpose in our next to supply a method of cultivation which will ensure 4,840 plants to the acre, if the creeper be cut when the bine or stems are 24 feet in length. Of course if cut but once a year greater length wil be secured, but the object is to obtain the finest fibre, which only young plants or stems will produce.—*The Indian Amateurs' Guide.*

Crop and Weather Report.

General Remarks.—Slight rain has fallen in several districts in the Bombay presidency and generally throughout the Punjab. In Bengal, the Central Provinces, and in the Central India and Rajputana States slight local showers have occurred. In Assam heavy rain continues to fall.

Prospects remain unchanged in Madras, and the harvest yield is reported to be below the average in some districts. In Mysore prospects continue unfavourable.

In Bombay and the North-Western Provinces and Oudh, the *rabi* or spring harvest is approaching completion and preparations for the *kharif* or autumn crop have begun in places. The *rabi* harvest is in active progress in the Punjab, and has been nearly completed in the central provinces, where threshing and winnowing are going on. In the Berars the *rabi* crops have been reaped, and preparations for the *kharif* are progressing. In the Central India and Rajputana States agricultural prospects are generally good.

Rain is much wanted in Bengal to facilitate agricultural operations. Sowings continue in Assam, and prospects are on the whole favourable.

Cholera and smallpox are generally prevalent.

Prices are fluctuating in the Punjab, and show a tendency to rise in Bengal. In other Provinces they remain generally stationary.

Madras.—Prospects fair, except in parts of Bellary and Anantapur.

Bombay.—Slight rain in parts of sixteen districts. Standing crops injured by floods in parts of Shikarpur; sugarcane slightly improved by rain in parts of Belgaum; preparations of *kharif* crops in progress in parts of Dharwar, Satara, and Khandesh. Scarcity of drinking-water in parts of seven talukas of Dharwar, four of Belgaum, and two of Bijapur, and of fodder in parts of three talukas of Dharwar and four of Belgaum. Cholera and smallpox in parts of eleven and fever and cattle-disease in parts of nine districts.

Bengal.—Weather very hot; slight rain fell in some districts, chiefly in the Dacca and Chittagong divisions; rain is urgently wanted. Agricultural operations are retarded for want of it in some places, though sowings of early paddy and some *bhadoi* crops are going on. *Boro* paddy and *dalua* are being harvested. Prices of foodgrains show a slight tendency to rise. Public health on the whole good.

N. W. Provinces and Oudh.—Harvesting nearly completed. Markets well supplied and prices generally steady. Cholera continues in Agra, new cases reported from Saharanpur and Aligarh, otherwise public health fair.

Punjab.—Rain in all the districts of the province, except Hissar, Delhi, and Umballa. Health good; a few cases of cholera have occurred amongst pilgrims from Hardwar and Delhi. Outturn of crops in Lahore district poor, elsewhere prospects are on the whole good. Prices fluctuating.

Central Provinces.—Weather continues uncertain with occasional stroms. Prospects are unchanged.

British Burma.—Slight smallpox and cholera here and there, otherwise public health good; health of cattle good. Slight rainfall in some districts.

Assam.—Weather hot with occasional wind. Sowing of *aus* crop nearly finished; prospects good. Public health fair.

Mysore and Coorg.—Paddy crop in good condition. Rain much needed for coffee plants. Prospects of season and public health good.

Berar and Hyderabad.—Weather cloudy *Rabi* harvest over; *kharif* preparations progressing.

Central India States.—Weather hot and cloudy. *Rabi* crops harvested, outturn about average.

Rajputana (Abu).—Weather clear since 19th instant and seasonable.

Napal (Khatmandu).—Weather hot and dry. Prospects indifferent owing to want of rain.

SIMLA, 27TH APRIL.

The barometer is still falling every where except on the north-west coast of the Bay. The fall is moderate in Rajputana, the N. W. Provinces and Bengal, and somewhat irregular in the Peninsula. The pressure is lowest in the Punjab hills and western districts of the N. W. Provinces, and highest on the west and south-west coasts, Arrakan, and Assam. Westerly to north-westerly winds prevail in Rajputana, the N. W. Provinces Central Provinces and Central India, southerly in Bengal, generally northerly in the Punjab, and unchanged on the coasts. The skies are overcast in the Punjab and Assam, and slightly clouded in the Delta and Northern Circars. The temperature has fallen rapidly everywhere especially in the Punjab. Light general rain has fallen in the Punjab, west of Lahore, in the Assam and parts of Bengal. Rain to-day—Dhubri, 1 inch; yesterday—Darjeeling, Tounghoo, 1 inch, Dhubri, Rajamandry, ¾ inch.

SIMLA, 30TH APRIL.

The barometer has fallen over nearly the whole of the plains of Northern-Western and Central India. The pressure is lowest along the Himalayas and highest in the west and south of the Peninsula. A small relatively low area of pressure lies over the Decan. Dry parching west and north-west winds blow in Northern and Central India as far east as Western Bengal; north-east or east winds in Nagpur, Seoni, and Jabbalpur; westerly on the Bombay coast, and the same as yesterday on the east coast. The weather is fine and the skies cloudless in Northern India. There is some cloud in Madras. The temperature has risen considerably in North-Western India, except in the North-West Himalayas, and fallen generally in Bengal. Rain to-day—Chittagong, seven-fourths Sibsagar, 1 inch. Showers are reported from Rangoon, Moulmein, and Akyab. Yesterday—Moulmein, ½ an inch.

METEOROLOGICAL observations to be of scientific value must be made on a uniform plan, otherwise the results will not be mutually comparable. The Meteorological Society of England, insists on uniformity, and only accepts the observations of those persons who comply with its requirements, and whose stations and instruments on inspection have been found to be satisfactory.

Instruments.—The *necessary* instruments are: —Standard Barometer; Dry-bulb Thermometer; Wet-bulb Thermometer; Maximum Thermometer; Minimum Thermometer; Rain-gauge; and a Stevenson's Thermometer Screen. It is *desirable* to have also a Black-bulb Maximum Thermometer *in vacuo*: a Bright-bulb Maximum Thermometer *in vacuo*: and a Minimum Thermometer without attached scale for terrestrial radiation. One or more Earth Thermometers, an Anemometer, and a Sunshine Recorder are usefull additions.

CONTRIBUTIONS.

JOURNAL OF THE AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.—Vol. II. Part iii. New Series, 1885. By the Secretary.

THE PROCEEDINGS OF THE ORDINARY GENERAL MEETING OF THE AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.—Held on Wednesday, the 25th March, 1885. By the Secretary.

THE INDIAN AMATEURS' FLORICULTURAL HORTICULTURAL AND AGRICULTURAL GUIDE.—Ranikhet N. W. P. By the Editor.

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THE establishment of an Agricultural Department for Bengal is an accomplished fact at last. A special officer has been sanctioned for two years to advise the Lieutenant Governor in matters relating to Agriculture and Statistics; to undertake the preliminary inquiries in connection with the experimental Field Survey of the Patna Division; and to assist in obtaining detailed information in regard to the creation of a local agency of record in Wards' and Government Estates. Mr. Finucane, a Bengal Civilian of whom His Honor the Lieutenant Governor of Bengal entertains a very high opinion, has been appointed to this office. He will be styled as usual Director of Agriculture.

* * *

Sanction has also been given to the appointment of an officer for one year to take charge of the Government Estates in the Shahabad District in connection with the scheme of agricultural improvement. Mr. Allen who, in addition to his qualification of being a Bengal Civilian is also a graduate of the Cirencester Agricultural College, has been gazetted for this appointment.

* * *

Special attention of the Lieutenant Governor was called by the Government of India to the possibility of making use of the services of the Cirencester graduates in any scheme that might be adopted. Accordingly, His Honor the Lieutenant Governor has thought fit to provide for two out of the three Cirencester graduates now in India. They will be entrusted with works connected with agricultural inquiry. In addition to this, they will have other works to do. It would be a great mistake not to wholly utilize the skill of a trained agricultural agency in the agricultural line alone and a greater one still to fritter away its energy in doing things which might very well be done by others.

* *

The duties of the Director of Agriculture will be manifold. Efforts should be made to form committees of gentlemen, European and Native, interested in agriculture, for instituting improvements directed by the Cirencester graduates. Local agricultural exhibitions should be got up by such local committees. The advice of these graduates should be taken by the Managers of Wards' Estates which may support experimental farms. Here we take exception to an expression used in the resolution. The Cirencester graduates are not mere "trained theoretical farmers" as the Lieutenant Governor has been pleased to style them. From our personal knowledge of the course of instruction in the above College, we can confidently assert that so far as English agriculture in certain districts of England is concerned, they are thoroughly practical agriculturists. Besides the knowledge of English agricultural practice, some of them, we know, have good deal of experience of the practice of agriculture as carried on in Bengal.

* * *

Our farmers have not to learn from Europe that farm-yard manure is valuable for all sorts of crops. The above name, we might just as well add, is given to the excrements of the farm stock which in this country consists almost exclusively of a few heads of cattle kept by almost every householder in a village, plus the straw, house-sweepings, and other refuse matter of the household. A very common sight in villages all over Bengal is the heap of this composite mixture which is known in European countries by the name of F. Y. Manure.

While its value is generally known by our peasant farmers, very few know what its value consists in, and it is necessary to know that, before one can take an intelligent interest in the application of the manure.

* *

It is not of invariable or fixed composition as some other manures are. The composition varies according to the character of the animals contributing to it, the quality of their food, the nature and proportion of straw and other foreign matters. In the case of an adult animal, say a working bullock, the excrements will contain the same quantity of valuable constituents of manure as was present in the food consumed. If, however, the animals are young and increasing in size, producing young, or giving milk, the excrements will contain less valuable matter. The manure made from the latter class of excrements will therefore be of less value than that made from the first class. A cow in full milk for instance can never give rich manure. If all the valuable constituents of food are used up in building up the body of a thriving young animal, the excrement can hardly be expected to contain anything of importance as manure.

* *

Similarly the nature of food greatly influences the quality of manure. Animals fed on rich food give richer excrements than those fed on poorer materials. For instance, cows feeding on straw and grass alone, will yield very inferior manure to what will be produced by those fed on grass, grain, bran, etc.

* * *

The treatment of the manure is also very important. The manure heaps of our country are exposed to sun and rain without any protection whatsoever. The sun does not injure them much but rain washes away the most important constituents of the dung heaps, which unfortunately are very soluble. The black dirty looking liquid mass that we see so often flowing about cow-sheds and dung-heaps, are the most valuable parts of the manure, and it is these parts that are usually allowed to run to waste. The manure heaps will be fifty times more valuable than they are now, if these constituents in the form of liquid mass be not allowed to waste, but conserved and protected. It might just as well be mentioned here that the urine of all animals is much richer in manurial constituents than the solid excrements and by the waste of the liquid mass described above, this valuable part—urine—is lost. A belief commonly shared in this country seems to be that the ash of the dung is just as good as the dung itself or better. Many well-to-do farmers who can afford for fuel and easily spare the dung, do however burn the dung made into cakes in the belief that the ashes will be of as much use for the soil as the dung itself. No opinion can be more erroneous. The most valuable constituent of the dung is lost in the process of burning and the worst feature is that very few seem to know the fact. If this fact were generally known and commonly understood, even our poorest peasant farmers who can ill afford to spare the dung, will try to do so. Much of the misuse of the dung springs from ignorance of its quality. The ash will do some good no doubt to the soil, but the comparative value of it will be very much less.

* * *

As in soil so in manures the most important constituents are *nitrogen, phosphoric acid* and *potash.* Let the manure be dung, bone or saltpetre, it is these elements that give them their manurial value. The manure which goes by the name of *guano* is valued for the nitrogen or phosphoric acid which it contains and is classed as nitrogenous or phosphatic according to the preponderance of nitrogen or phosphoric acid in it. Before the secret of artificial manures, such as nitrate of soda, sulphate of ammonia, kanite etc., was commonly known in England, which she owes mainly to the exertions of Sir. J. B. Lawes of Rothamsted, *guano* was *the* manure of the farmers and they used to pay heavily for it. They used to import nearly million tons yearly of this manure from Chili and Peru. The adoption of nitrate of soda and sulphate of ammonia have almost driven away *guano* from the British field.

*

Another very important function of the F. Y. Manure is to improve the physical condition of the soil by increasing its absorptive power for water and heat. A soil with a liberal dressing of this manure will stand drought much better than a similar one without it. It acts like a sponge in aborbing and retaining water.

* * *

To illustrate the enterprize of the British and to simulate a similar virtue in our home farmers, we might mention a very important fact. When the stores of rich and better class *guano* had well nigh been exhausted, and the secret of artificial manures not commonly known or understood, the British farmers had to look about for a few years and the search for natural fertilizers in all parts of the globe was greatly stimulated. Amongst the discoveries of new sources of fertilizing matters during this crisis, the name of *Bat's guano* deserves to be noticed. This manure was found out in Arkansas, Texas, in the South of Spain, in Jamaica, on several islands,

in the Bahamas and on several East Indian Islands and, latterly, also in Africa.

* * *

This fertilizer is found in caves, inhabited by innumerable bats attracted to the neighbourhood of the caves by swarms of insects which infest swampy districts in semitropical countries, and which afford abundant food to the winged mammals. The most extensive accumulations of this manure appear to have been found in Texas and Arkansas. Some of the caves yield hundreds of tons. The number of bats frequenting the caves amounts to millions and when they issue forth, they darken the air as if a great volume of smoke were pouring out from the opening. These caves cover miles of ground and yield millions of tons of the rich fertilizer.

* * *

Long time must yet elapse before our farmers are able to grasp such an adventurous idea. But we have plenty of manurial resources in our own country which only wants tapping. We would suggest here one valuable manure which, with a little enterprize, may be placed within easy reach of every farmer. The bones of dead cattle and other animals are now mostly wasted. A little of it we know, is collected and utilized in sugar refining but no use is made of the rest. Bones contain in their composition an element very valuable for all crops, especially cereals. This valuable element is phosphorus. The great difficulty in applying bones to land, is the want of cheap and handy machines to grind them before application. As long as such a machine is not invented, we should recommend the practice of burning bones to charcoal which it would be then easy to grind before application to land. If the farmer wants to do without grinding altogether, the bones may be burnt to ashes and the ashes applied. Certainly there would be waste of some very valuable manurial constituents by burning bones to charcoal and more so to ashes; but the phosphoric acid for which especially we recommend the use of bones here, will be all left in the ash. It is to be hoped that under the direction of trained agriculturists, the village *Chamars* or low castemen be made to collect the bones lying about in the neighbourhood of all villages and burn them in heaps in some out of the way place so as to prevent nuisance from burning. The charcoal after powdering or ashes may be distributed to the ryots and their usefulness tested. By way of trial 2½ cwts. may be applied per acre or say one maund per bigha.

* * *

There were 725 births registered in Calcutta in March against 637 in the preceding month, showing an annual ratio of 20 against 17·5 per 1,000 of population. The number exceeds all the corresponding figures of the past decade and surpasses the decennial average by 143. There were 375 male and 350 female births registered during the month. The mean of the decade was 582.

* * *

There were 1,916 cases of vaccination and 491 re-vaccination performed in March against 1,829 and 450 respectively in the preceding month. Of the primary vaccination 980 were under one year of age, 79 above one year and under six years, and 140 above 6 years. Of the 1,916 cases, 1,828 or 95·4 per cent were successful, 8 or ·41 were unsuccessful and 80 or 4·1 were doubtful or could not be traced. There were 1,000 males and 916 females vaccinated, and 343 males and 148 females re-vaccinated in the month under record. Among the different races, 1,674 were Hindus, 551 Mahomedans, 99 Mixed races, 71 Non Asiatics and 12 other classes.

* * *

The number of deaths registered in March was 1,175 exclusive of still-births against 1,082 in the preceding month, giving an annual ratio of 32·5 against 29·9 per 1,000 of population. The proportion of male to female deaths was as 146 to 100. The monthly total is less than five corresponding totals of the past decade, and is also below the decennial mean by 17. The diminution of 285 deaths, as compared with those of the corresponding month of the previous year, is chiefly observable under the heads of cholera and small-pox, and is also shared by all classes of the community. From cholera there were 242 deaths against 153 in the preceding month. The number is less than four corresponding figures of the past decade. There were 32 deaths from small-pox against 25 in the preceding month. The number is less than five corresponding figures of the past decade, and falls short of the decennial mean by 62. The deaths from fever amounted to 316 against 345 in the preceding month. Although the figure exceeds seven corresponding totals of the decennium, it falls short of the average by 5. From bowel-complaints there were 124 deaths against 138 in the preceding month. The figure exceeds all the corresponding totals of the past decade excepting 1876, 1878 and 1883, and surpasses the decennial mean by 9. The mortality from other causes amounts to 450 against 409 in the preceding month. The number exceeds all the corresponding figures of the past decade save 1880, 1881 and 1884, and is higher than the average of the decennium by 46. With regard to the local distribution of diseases, the following Sections show the highest death-rates, *viz.*, Hastings 53·3, Jorasanko 50, and Puddopooker 42·1. The following

Sections show death-rates below the average, *viz.*, Waterloo Street 12·4, Bamunbusti 15·6 and Park Street 24.

*

Infant mortality reckoned on estimated births was 308·9 against 592·2 in the preceding month per 1,000 of population per annum. Among the different races, the ratios were as follows, *viz.*, Hindus 310·8, Mahumedans 352·5, Christians 177·6 and other classes 153·2.

* * *

Some very curious statistics as to papermaking have recently been compiled on the Continent. It seems that there are 3,985 paper mills on the face of the earth, in which annually 1,904 million pounds of paper are manufactured. Half of this paper is used for printing; 600 million pounds only for newspapers, the consumption of which has risen by 200 million pounds during the last ten years. As to the use of paper by individuals, an avarage of 11½ lb. is used by an Englishman, 10½ lb. by an American, 8 lb. by a German, 7½ lb. by a Frenchman, 3½ lb. by an Italian or Austrian, 1¼ lb. by a Spaniard, 1 lb. by a Russian, and 2 lb. by a Mexican.

* * *

We learn from a local contemporary the following:—The report on the Dewali Horse and Cattle fair which was held at Amritsar so long ago as October last, has only just been published, and though the number of animals brought to the fair was some 40 per cent. less than in the previous year, this is considered rather a favourable sign of the prosperity of the people. The autumn harvest in 1883 was a very scanty one, whilst that of 1884 was an abundant one. The cultivator after a bad season first disposes of his buffaloes, as they are of little use for farm work as compared to the plough and well bullocks, and it was amongst buffaloes offered for sale that the chief falling off in the number of animals brought to the fair last year took place, the number being 28,000 odd less. So far as bulls, bullocks, and cows were concerned there was an increase of 1,919, but again there was a decrease in the number of cattle brought from Malwa, which is generally considerable. This is attributed to the severe sickness which prevailed in that part of the Panjab at the time. The average price realised at the sale of cattle, was only five annas eleven pies less than in 1883. The number of camels brought to the fair increased by 479, but they do not seem to have been up to the average, as, though 84 out of 177 animals which competed were awarded prizes, only about three-fourths of the sum sanctioned was expended in prizes. The number of horses, mules, and donkeys exhibited was 4,246 as compared with 4,138 at the previous show, but the number of sales was not so large. In 1883, 3,088 animals sold for Rs.1,69,562, whereas in 1884, 2,862 sold for Rs. 1,567,02 giving a better average on the whole. The price paid for remounts was Rs. 250, but as there were representatives of ten different cavalry regiments in the market to purchase, the supply did not prove equal to the demand. Rs. 425 were awarded as prizes to mares and geldings, the *bonâ fide* property of breeders and owners belonging to the district, for the purpose of encouraging branding and breeding from Government stallions. The fair was, as usual, well managed and there was very little illness amongst the visitors and the Lieutenant Governor has sanctioned the distribution of Rs. 243 in rewards and khilluts to the head native officials and others who rendered good assistance in the management of the fair.

* * *

We are glad to present our to readers a summary of the report describing the working of the Cattle Disease Act No. II of 1866 in Madras. The Act had been in existence for nearly ten years, before its provisions were applied anywhere. It was first introduced in 1876 on the occurrence of an outbreak of *reinderpest* among the cattle on the Coffee Estates of the Wynaad taluk of Malabar. The measures of precaution and notably those of seggregation voluntarily adopted by the owners and superintendents of the Estates under the supervision of a veterinay surgeon, had the effect of speedily checking and eventually eradicating the disease. The Act was next extended to the Nilgiris in 1879 in consequence of an outbreak of *reinderpest* among the Toda herds and Badaga cattle. Hospital pounds were established at different centres according to the varying conditions and progress of the disease and a system of inspection by the hospital pound keepers in the villages within their ranges was instituted. The people themselves were fully alive to the advantage of breaking up large herds and seggregating the sick and resorted freely to these precautionary steps. The power, conferred by the section 10 of the Act, of killing infected animals was very sparingly used and only three animals appear to have been destroyed. The Act does not provide for any compensation for the animals destroyed, but to enlist the sympathy and co-operation of the cattle owners, the Magistrate of the district sanctioned the grant of compensation but only Rs. 20 seem to have been paid on this account. The disease disappeared in about six months, the animals that appear to have been affected were 256 of which 98 succumbed, giving the percentage of death as 38 of the whole number affected.

* * *

The Act was next applied to the Trichinopoly district in 1882. Pounds were established, medicines distributed, and every precautionary measure adopted, excepting the provision of the section 10 of the Act. The disease which appeared in the latter end of 1882 was eradicated by the end of 1883. The Act was next extended to the Vizigapatam district, but its provisions were not necessary to be put in force. The collector of Kistna in which the Act was introduced in 1882, reports that in considerable part of the district the act was a dead letter, a few hospitals were opened, but the ryots showed great disinclination to send their cattle to them, alleging that their cattle had much better chance of recovery if treated and seggregated in their own fields. The collector of Chingleput to which the Act was introduced in 1884 says, that its introduction has produced no appreciable effect and that it cannot be expected to do so till it has been longer in operation. The tours and inspections of the Veteriuary officers, if they have done nothing else, have opened the eyes of owners to the necessity of treating and seggregating cattle when attacked by infectious or contagious diseases.

* * *

The Inspector of Cattle Disease writes that the introduction of the Act in the Vizigapatam, Kistna and Chingleput has not been in his opinion attended with any measure of success. The causes of failure in his opinion are—(1) the indifference of village officers, (2) ignorance of owners, and (3) the want of power on the part of the officers of the Veterinary Department to enforce the provisions of the Act. Mr. Wilson, the Director of Agriculture, sums up the report by saying that "as records of the working of the Act and of the effect of the application of its provisions in combating and stamping out cattle disease, the majority of the reports are of no value, but the experience of its working in the Nilgiris, the reports on which embodied in the orders of the Government already quoted are the fullest we have and the experience of the Wynaad in 1876-1878 go to show that seggregation, prompt and immediate, is the best way of checking the spread of disease and that proper medical treatment will save a large percentage of the animals attacked." It will be thus seen that our article on Cattle Disease which appeared in the last issue of this journal, laid similar stress on measures of prevention and seggregation.

A proposal has, we hear, been put forward for the formation of a Civil Veterinary Department in the presidency of Madras. At present, local Cattle Disease Inspectors are recruited from the passed students of the Agricultural College, who, after passing through their collegiate course, have received a year's further instruction in a separate class presided over by Mr. Mills. It is now, we understand proposed that this special class, which is at present regarded as only a temporary arrangement and altogether apart from the college, should be incorporated in that institution and become a permanent branch of its curriculum, from which a supply of qualified Veterinarians should be drawn for service, in the same way as are Civil Hospital Assistants and Apothecaries, their pay also being regulated on the same scale and provided for from Local and Municipal funds, to which, on the other hand, the whole of the surplus of the Cattle Pound Fund might be made over. For the administration of the department, it is proposed to frame an organization something after the fashion of the Surgeon-General's department, but of course, on a more moderate scale. Three Inspecting Officers (a head and two Deputies) are proposed to be appointed who would be entirely separate from the Educational staff, and would work under the control of the Agricultural Department, their cost being met from Provincial Funds. The scheme has the approval we hear, of the Board of Revenue, by whom it has been favourably recommended to Government for adoption.

* * *

A local contemporary says:—It is a thousand pities that we have no adequate means of checking the internal trade of India. The external trade can be reckoned with comparative accuracy, but the internal trade, which is vastly more important, is a thing of which we know almost absolutely nothing. It was only the other day that the Bengal Government made an open confession of its helplessness in the matter of economic statistics relating to the conditions of rural life in the province but it is much more startling to think that throughout the whole empire there is no means of ascertaining conditions of those industries and movement of trade upon which not only the welfare, but the maintenance of the population depends. In any branch of trade, we can only tell how matters stand by the slight touch we maintain at the ports. Practically the whole of the interior of the country is a blank, and even the light that might be thrown upon the subject by our railway traffic is not taken advantage of. It is easy, however, to perceive the immense importance of a means of checking the amounts and the exchange of produce which never reaches the seaboard; but it is a different thing to outline a system for a Statistical Department which might be expected to cope with the problem we are considering. The present returns of railway borne traffic published by Government, do not give

a clear idea even of the small portion of the trade with which they deal. They merely scratch the surface of the enormous trade movements which are required for the sustenance of a population of 250 millions, and the information they give is often presented in the form of an Asiatic mystery.

* * *

The following simple rules for horse selection are from *Turf, Field, and Farm*:—

1. Never take the seller's word: if dishonest, he will be certain to cheat you: if disposed to be fair, he may have been the dupe of another, and will deceive you through representations which cannot be relied upon. 2. Never trust to a horse's mouth as a sure index to his age. 3. Never buy a horse while in motion; watch him while he stands at rest, and you will discover his weak points. If sound he will stand firmly and squarely on his limbs, without moving any of them, the feet planted flat upon the ground, with legs plumb, and naturally poised. If one foot is thrown forward, with the toe pointing t the ground and the heel raised, or if the foot is lifted from the ground and the weight taken from it, disease of the navicular bone may be suspected, or at least tenderness, which is a precursor of disease. If the foot is thrown out, the toe raised and the heel brought down, the horse has suffered from laminitis, founder, or the back sinews have been sprained, and he is of little future value. When the feet are all drawn together beneath the horse, if there has been no disease there is a misplacement of the limbs at least, and a weak disposition of the muscles. If the horse stands with his feet spread apart, or straddles with the hind legs there is weakness of the loins, and the kidneys are disordered. When the knees are bent and the legs totter and tremble, the beast has been ruined by heavy pulling, and will never be right again whatever rest and treatment he may have. Contracted or ill-formed hoofs speak for themselves. 4. Never buy a horse with a bluish or milky cast in his eyes. They indicate a constitutional tendency to opthalmia, moon blindness, etc. 5. Never have anything to do with a horse who keeps his ears thrown backward This is an invariable indication of bad temper. 6. If the horse's hind legs are scarred the fact denotes that he is a kicker. 7. If the knees are blemished, the horse is apt to stumble. 8. When the skin is rough and harsh and does not move easily and smoothly to the touch, the horse is a heavy eater, and his digestion is bad. 9. Avoid a horse whose respiratory organs are at all impaired. If the ear is placed at the heart, and a wheezing sound is heard, it is an indication of trouble. Let him go.

The following Resolution of the Bombay Government on the subject of the Cattle and Agricultural Show which was held in Poona in Decemder last, has been issued:—

These papers contain an account of the first Poona Cattle and Agricultural Show held under the new arrangement sanctioned in Government Resolution No. 5055, dated 23rd June 1884. The Show was on the whole successful. The Collector is of opinion that the Horse and Cattle Shows should be held in succession at the same place in September or October, in order that the same sheds and pendals may be utilized for both, and that the presence or co-operation of the district officers may be secured. But the Commissioner C. D., points out some forcible objection to the adoption of this course, and in view of the superiority of the Show there does not appear to be sufficient ground for modification of the order given on this point in the Resolution above quoted.

* * *

The total number of cattle exhibited was 250. The animals were generally of good quality. The best bullocks were those of the Khillari and Malvi breeds. Few buffaloes were exhibited. Prizes of the value of Rs 701 were awarded for cattle. The number of exhibits of different kind of grain and seeds was not large, but the articles exhibited were of a very good quality, and prize of the amount of Rs 301 were awarded for the best specimens. The fruit and vegetable exhibited were also good. A specimen of ensilage which was offered for sale does not appear to have attracted favourable notice on the part of owners of stock as it realized Rs 3-4-0 only while its preparation cost Rs 32-2-0.

* * *

A separate report submitted by Mr. Ozanne on an experiment conducted under his supervision to test the relative powers of the sugar-cane mills shown by Messrs. Ewart, Latham & Co. and Mr. Subrao of Poona, was communicated to all district officers with Government Resolution No. 997, dated 2nd February 1885. A trial of different ploughs of an improved pattern was also made, but as the experiment could not be completed at the time of the Show, Mr. Ozanne has arranged to continue it under the supervision of Mr. Woodrow at the College of Science and Messrs. Stormont and Strachan at the Government Farms. A sub-soil plough made by Messrs. Royal and Shearer at the College of Science Workshops is considered to be a very good implement.

* * *

A new feature of the Show was that four special prizes were offered for the best essays on subjects relating to agricultural operations. Prizes of the

value of Rs. 125 were awarded to eight of the competitors. Two prizes were also awarded for the best collections of different varieties of wheat grown in the Bombay Presidency and of different species and varieties of cereals, pulses and oilseeds grown in the Poona District. The thanks of Government were conveyed to the Judges, the Honorary Secretaries and to Major Babington for the valuable assistance rendered by them, and to Khan Bahadur Kharshetji Edalji and Dr. Ghole for the public spirit shown by them in placing their grounds at the disposal of the Committee.

* * *

A local paper thus summarises an official report on an exhibition of silk cocoons held at Berhampore in January last :—It was primarily intended for Moorshedabad District, but the Collectors of the neighbouring districts of Rajshahye, Beerbhoom, Maldah and Nuddea were supplied with notices of the exhibition, and requested to encourage breeders in their districts to send exhibits. The total sum given in prizes on the occasion was Rs 2,067, the individual prizes ranging from Rs 75 down to Rs 5. Besides, exhibitors who did not gain any prize were each given one rupee as diet money and compensation for the trouble and expense to which they had been put. Of the 189 prizes, rearers of the Moorshedabad District gained 173, aggregating Rs. 1,856; those from Beerbhoom 11, worth Rs. 125; those from Nuddea 4, worth Rs. 70; and the single exhibitor from Maldah gained a prize of Rs. 16. Mr. Anderson, the Collector of Mursidabad, hopes to see the usefulness of the future exhibitions enlarged by extending their scope so as to illustrate the process by which silk is made, and the final products. The exhibition would certainly in that way be made more interesting to the general public.

* * *

The Parsis of Bombay are a well known enterprising race of India and it would be very interesting to note a few points regarding their enterprize in external trade. The commencement of the Parsi intercourse with China seems to have begun about the year 1756. The cargoes taken out of India consisted principally of opium or cotton and the ships returned with a new freight of which no inconsiderable part was cash. They had an intermediate Station at Penang, where the Chinese used to meet their agents from Bombay. To keep pace with the requirement of the time, they built ships of their own. They also turned their energies in the direction of Arabia and Madagascar. They used to import articles of consumption among Englishmen, to conduct financial transactions, remit sums of money from one place to another and deliver letters wherever they had agents. More than one Parsi firm now exists in the city of London. The example once set by the Camas of Bombay in 1855 has produced good results. In 1798, the Parsis had 21 ships of which the largest exceeded 1000 tons. Since the introduction of steamers their trade gradually declined. Thwarted in this direction, they turned their energies in opening spinning and weaving mills.

FISH AND THEIR CULTURE.

It is generally stated that the supply of fish has now-a-days fallen off considerably. In the absence of any statistics on the subject, it is very difficult to pronounce any general authoritative opinion supporing or contradicting such a statement. In a district with which I am acquainted in Bengal, my experience corroborates the assertion so far as that district goes. A big river and few other smaller streams which serve as water courses of the district used, I am told, to yield more fish in former days and it is a positive fact that within my experience I have seen a great decline. I remember that in our younger days immediately after the rainy season, these rivers and streams used literally to be swarmed with fish. The river and the streams are there, and the demand continues the same or is increasing, how it is that the supply has fallen-off? The question naturally arises, what is the cause of this diminution? And how it affects the Indian people?

To take the second question first. It would be a truism to repeat that the percentage of fish eating people in India is very great. More people eat fish here than they eat meat in England or Europe. Fish is not a luxury in India, it is one of the necessaries of life. If we except the Mahomedan population of India, animal food in the form of meat forms an essential part of food of a very small percentage of the people. The only animal food the use of which is almost universal is milk and fish. A question which attempts at reviving, keeping up or improving the fish-supply of India is a question of grave importance.

What are the causes then of diminished fish-supply? Like all living animals, fish require food for their life and growth. They can not live on water alone in which they swim, no more than we can live on air in which we are immersed. Sir J. B. Lawes, the greatest living authority on scientific and

practical agriculture, points out that "inorder to any manufacture whatever, there must be raw material provided. This is a truth which app'ies to all produce, whether vegetable or animal—to the manufacture, in fact of the fishes of the sea, as well, as that of the fruits of the earth." Before I take up the question of food supply for fish, a few words about their chemical composition will not be out of place. In 1,000 lbs. of fish (sprats), Professor Way found 20 parts of nitrogen, 8½ of phosphoric acid and 4½ of potash. In the animals of the farm at Rothamsted, Sir J. B. Lawes found about 20 parts of nitrogen, 10 to 12 parts of phosphoric acid and 1½ of potash. Of fat or oil the fish (sprat) contains about 19 per cent, which is much the same as the amount found in a store sheep or ox."

I wish I could support the above statements by quoting analyses of fish and farm animals made in this country, in the absence of which the above statement may be taken as approximately correct for India or any other country. Fish must have supplied to them elements of food found in their composition. They have one great advantage over other ani mals from their not using up a large amount of food in merely keeping up the temperature of the body. A cow, for instance, under ordinary conditions of life requires six times as much food for keeping up the heat of her body as for building up or repairing her muscles etc. The demand for food supply of fish is therefore considerably less. But still to increase in weight, they require nitrogen, phosphoric acid and potash which must be obtained from the water or from the beds of rivers and streams. If the bed through which the river flows is sandy and the basin of which it receives the drainage rocky, it would be useless to look for an abundance of fish. On the other hand, in rivers and streams the source of which is cultivated or clothed with natural vegetation, the reverse is expected. Bearing on this point, I produce an extract from a very valuable letter of the same great authority whom I have mentioned above. "In the report of the Rivers Pollution Commission we are furnished with analyses of almost every river and lake in Great Britain. The rivers which have their source in the Highlands of Scotland frequently contain no nitric acid; there is nothing to support aquatic vegetation, or the animalculæ which live upon it, and consequently there is but little food for the fish. It is true that a considerable number of salmon are found in some of these rivers at certain periods of the year, but it is well known that they take little or no food as they go up for the purpose of spawning, and lose considerably in weight during the process; this, therefore, is quite a different case. As a matter of fact, many of the most beautiful lakes and rivers in Scotland are very bare of fish. In a district with which I am well acquainted in the Highlands there are a number of small streams containing trout which rarely exceeds one or two ounces in weight. In two of these steams, however, much larger fish are taken. One receives the drainage from a kennel of dogs, and the other the drainage from a highly manured potato field. Close to where I reside in Hertfordshire, the Ver, or Colne, has its origin in the chalk. The bed of the river is just now quite dry owing to the low rainfall, but trout will grow to four or five pounds in weight, although, as a rule, there is hardly water enough tocover their backs The water in this stream springs from the chalk; it contains an abundance of nitric acid, and is celebrated for the water-cresses which are grown for the market in large quantities These are manured with superphosphate of lime, and if ever the cultivation of fish becomes a trade in England, this phosphate will play an important part in increasing their production. Sewage must, therefore, largely increase the production of fish prvided that it is sufficiently diluted, and does not interfere with their health. In rivers and lakes, a knowledge both of the ingredients contained in the water, as also of those in the soil which froms the bed of the water, will give tolerably correct information regarding its capability to produce fish."

From this it is evident that fish are as much amendable to cultivation as crops and that there must be abundant supply of food before we can expect a similar abundant supply of fish. Hence one of the causes of decline in fish-supply is not far to seek. The evil effects of felling trees and cutting down forests in diminishing the rainfall of an area are too well known to require repetition here. It not only interferes with the medium in which fish flourish but materially diminishes the store of food in the water. In the district of which I was speaking, there is the river Damuda which takes its origin in the Ramgarh hills, flows through a rocky or sandy channel and receives the drainage of an area which is mostly rocky and almost bare of vegetation at its source. With these natural drawbacks the chances for the river producing abundant fish can never be very great. But what little chance it had, has been greatly diminished by indiscriminate felling down of timber trees and cutting down forest growths at the source of the river. The trees and forest growths not only influence the rainfall of a district but are a source of food for the fish in the river. In the first place, they disintegrate the rocks on which they grow and set free potash and phosphoric acid, two most essential elements of fish-food; and secondly add organic

matter to the water in the form of dead leaves, twigs, fruits, timber etc., which yield nitrogen in addition to potash and phosphoric acid. On the clearing of forests, the disintegration of rocks diminishes, the supply of organic matter is cut off, and hence the fallingoff of fish in rivers which are supplied with the drainage of such tracts. If however after cutting down forests the bare tracts are brought under cultivation, the supply of food so far as phosphoric acid and potash go increases; cultivation sets free these latter compounds from the soil in much greater quantity than natural disintegration. To make the point clearer and more impressive and to carry conviction even in most sceptic minds, I shall take the case of tanks. Whatever it might be in other parts, they are very common on this side of India and it is a well known fact that fish multiply and grow more rapidly in those tanks in which people bathe, wash their linen and cleanse drinking and eating plates. These of course by no means tend to keep the tank-water fit for drinking purposes, but nevertheless supply abundant nutriment matter for fish.

Once my attention was drawn to the comparatively barren condition of a certain municipal tank which was kept scrupulously clean and in which people were strictly forbidden to bathe and wash their linen and plates. Since then this has received confirmation from other quarters.

These considerations open up a very important question. Is the sewage of big cities and towns like Calcutta, Bombay, London discharged into rivers utterly wasted? Is this an utter destruction or is it accompanied by conservation? On this point also, I quote from the same authority whom I have mentioned above.

"There has been a very prevalent opinion that the sewage of London has been wasted. The evidence which I have brought forward will, I venture to hope, not only do away with this impression, but will also establish the fact that it has a decided influence on the production of fish. The absolute amount of this influence, however, is a question on which every one can form his own opinion. We have as a fact that the sewage of the Thames restores to the sea much more than the whole of some, and the greater portion of other, important manure ingredients which are annually taken out of it by our fishermen. His Royal Highness the Duke of Edinburgh, in his address at the South Kensington Fisheries Exhibition, estimated the annual value of our fish as between seven and eight millions. In the event of a large expenditure being incurred in removing the sewage nearer to, or into the sea, the ratepayers of the metropolis might possibly expect that some portion of the cost would be paid from the national purse, on the plea of their contributing so largely to the food of the fish. The Agricultural Holdings Act gives compensation for unexhausted fertility; but I fear that no provision has been made for compensation in the case of sewage which is discharged into the sea."

That which holds good for London will also hold good to a certain extent for any other town. In Calcutta a portion of the excreta of the inhabitants passes into the sewers from which it is discharged into the river. The urine of the immense number of horses, cattle, and other animals is chiefly disposed of in a similar manner. The loss of fertilizing matters in this way is enormous and is constantly on the increase owing to the extension of water-closets and main sewers. It is extremely desirable that this sewage should be utilized in irrigating market-gardens or grass-lands, the valuable effects of which on such lands have been placed beyond doubt by the various sewage experiments both in Europe and England. But as it is, it is not utterly wasted; on being discharged into the river, it gets diluted with the water in which form it serves as food for fish. There can be no doubt that the estuary of the Hugli is the breeding ground of innumerable shoals of fish for which sewage forms very valuable food. The food of fish that swarm certain parts of the sea is not as thought by some derived from the sea-water alone. The nature of the bottom of the sea and of the drainage water which may be called the sewage of a country mainly decides the barrenness or otherwise of a certain part of the sea. To judge *á priori*, since there are no regular fisheries round the sea-coast of India and if there be a few, no statistics about them are available, the northern part of the Bay of Bengal will be much richer in fish than any other part of the sea touching the coast-line of India.

Another and no less important cause which has brought about the diminution in fish supply, is that with the increase of population and hence of demand, greater attention has not been paid to the system of rearing fish. Indiscriminate destruction of fish as well of spawns at the spawning time is telling seriously upon the supply. People seem to think that no matter how they are caught and in what number they are killed, as long as the rivers and streams are there fish will grow and multiply. It need hardly be said that no belief can be more erroneous. By killing one fish at the spawning time, you do not destroy one but a whole progeny of them and this process if continued will sooner or later end in their total extinction. There are countries in which indiscriminate killing of games is forbidden by law. In Scotland, for instance, some farmers burn their grass lands when they grow too coarse and

rough but the law lays down that they can only do so at a certain time of the year, lest the games such as partridge etc, be disturbed or destroyed at the breeding or laying season. I must not be understood to mean that I advocate the adoption of a similar fish-law in this country, or the necessity for it. I simply draw the attention of our people to the principle underlying the law, the principle of conservation which is my point of contention. There should not only be the raw produce for the manufacture of fish but the product of manufacture used economically. Both food-supply and fish-rearing are as much amenable to cultivation as sheep or cattle and take the same place in the agricultural economy of this country as the latter do in Europe and other countries.

G. C. Bose, M. A., M. R. A. C.

AGRICULTURAL IMPLEMENTS.

Plough primitive and modern.

Much have been said about the present depressed condition of the agricultural class of this country, but up to the present moment hardly any practical steps have been taken ; no one who has studied the question need be told what are its causes. The soil does not yield now-a-days what it used to some twenty years ago, at the same time the costs of cultivation instead of decreasing have increased considerably. Had the prices of agricultural products of this country risen in proportion to the cost of production, the decrease in the yield would not have affected the condition of the agricultural class. Now this is very different to what generaly takes place in other countries, where the cost of production, if not the most, is certainly one of the most important factors which regulate the price of an article. Exactly so was with the agricultural produce of India before she had to sell the products of her soil in foreign markets in competition with other countries where the cost of production may be much less than here at present. But things have changed now: to meet the heavy and yet increasing demands made on her by a foreign Government, she is obliged to export a certain portion of her agricultural produce and sell it at any price she is offered in foreign markets. It is clear under these circumstances stated above that the increase in the cost of production in this country will not much affect the prices of agricultural produce in foreign markets.

We know of few countries where the natural advantages of growing crops at a cheap rate are greater than those we have in India. It is through ignorance and poverty of the peasantry and indifference of the educated and well-to-do class to the profession of agriculture that we cannot grow crops at a rate as cheap, nay cheaper than what they are doing in other countries. The problem which the above suggests is not simply to obtain the largest yield from a given area of land but to obtain it with the least possible expenditure; this can only result under most favourable conditions and by best conducted agricultural operations. The former are not always under the control of the agriculturist, but he can go far enough to ensure success by judiciously modifying the latter according to the varying natural conditions. In the present article I shall speak of only one of these numerous agricultural operations, *viz*, cultivation of the soil, and some of the principal implements used in it.

Objects of cultivation, by which I mean here only the operation of digging up and pulverising the soil by hoes, ploughs, rakes, harrows etc., are principally to make the soil loose so that the seedlings may not have any difficulty in sending down their tender roots, that there might be sufficient space made between the particles of solid earthy matter for the admission and retention of air and water which play such important parts in plant-life, and also to mix and distribute evenly the plant-food either already existing in the soil or put on the surface of it in the shape of manure. Such being the objects, let us see how this can be best secured.

To be able to compare the efficiency of different methods of cultivation, a little knowledge of the mechanical condition of the soil is necessary. I take the ordinary soil of the plains, that is, a soil free from small stones or gravel and having no substratum of rock within a few feet from the surface. Such a soil is generally hardest at the surface owing to its being constantly trodden by men and cattle and being dried by the action of the sun and atmosphere. Hoe though an instrument for weeding and digging up the soil between the plants and in such places where ploughing is impracticable, is frequently seen in this country used in breaking up large tracts of fallow land which might have been done at a less cost and in far less time with a properly constructed plough. This the Indian peasant does because his plough can not do the work as good. Now in hoeing, each time a turf is turned up the tool which is worked from the top has to make its way through the hardest portion of the soil, consequently a considerable part of the power given up by the laborer is wasted in order to overcome the resistance offered by the hard portion of the soil to the penetrating tool. Looking further into the operation we find that the power thus wasted in overcoming the extra resistance not only goes to reduce the ratio of the useful work done to the total amount of power (energy) spent

but also does positive harm; it produces heat which increases the temperature of the hoe-blade and makes the cutting edge softer, which constantly gets blunt and wears out sooner; besides, the work done by hoe is intermittent, useful work is done only during the time occupied in cutting and turning up the soil. During the rest of the time occupied in lifting the implement up in the air and letting it down, the laborer is simply transmitting from his own person and storing up in the implement the power required to do the above work. Consequently hoeing is not only uneconomical but also slow. A man would do a good week's work if he could hoe a quarter of an acre of fallow land, but with a proper plough the same amount of work can be done in about two hours and a half.

Ploughing which is done in this country is generally very inferior to that done in Europe. This inferiority is principally due to the inferiority of the implement and that of the draught-cattle. Of the latter I have little to say here, as they really do not fall under the subject matter of the present article, except to recommend to those interested in the agriculture of this country the introduction of better breeds or improvement of the present ones if possible, as the cattle now used in the agricultural operations are perfectly unfit for most of the modern improved agricultural implements which as a rule require heavier draughts. To be able to improve the plough of the country we must first know its defects and wants, and the easiest and best way to ascertain them is by examining the work done by it. According to the nature of the soil and crop, it is necessary to vary the depth of ploughing, so it is most necessary that the plough should have some means of varying the depth of the furrows cut and turned by it. Practically speaking the plough of the country raises no furrow, it only makes a sort of scratch or indentation on the ground, the width and depth of which varies respectively according to the width of the plough-share and the force with which it is pressed down into the soil by the ploughman. The earth raised by the plough-share is left irregularly on either side of the groove partly filling up the groove next to the last one and partly covering the ground yet to be ploughed. Figure I

FIG. I.

represents the tranverse section of a plot of ground once ploughed with the country plough from which the earth raised has been swept away. It is clear from the figure that the portion of the ground between the grooves is left untouched in the first ploughing and requires several cross-ploughings to break it up completely. With modern improved plough the work done is very different; it does not make grooves like the primitive plough in this country but cuts and turns up furrows of required sizes, leaving the ground underneath perfectly flat as shown in figure II.

FIG. II.

These furrows are left either at a certain angle or turned completely over, "thus exposing the lower soil to the fertilizing influence of the atmosphere, and burying all the surface vegetation, so that it decomposes and enriches the soil." It will also be seen from the figure that not an inch of ground is left unmoved, the furrow slices are laid uniformly towards the right and a clean cut is made on the left. The part of the plough which thus turns the furrow slices cut by the plough-share and coulter is wanting in the primitive plough of this country and is called the breast plate; it is an iron or steel plate attached to the plough-share having a gradual twist of more than a right angle. The part of the plough which makes the perpendicular cut on the land side has also no existence in the plough of this country; it is a tool resembling a knife plate, made of iron or better of steel, set almost perpendicularly to the beam of the plough and is called the coulter. This with the side-plate makes the perpendicular sidecut. Lastly we come to the part which is also wanting in the Indian plough but which is of most importance in many cases, *viz.*, the wheel or wheels by which the depth and the width of ploughing is regulated. When the plough has two wheels one is smaller than the other. The large or furrow wheel is placed on the right hand side running in the furrow on a level with the share, almost touching the perpendicular cut of the land side; consequently, the plough must not only

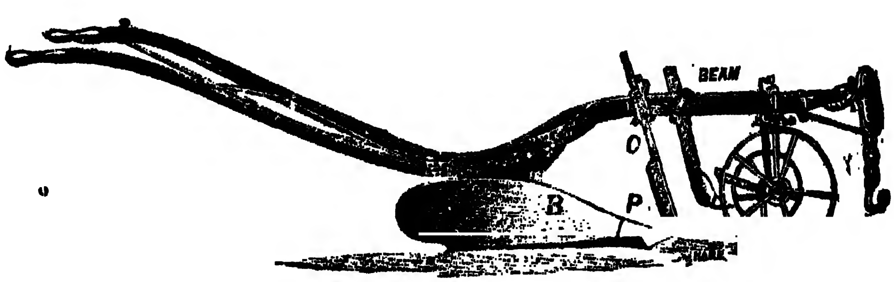
run but also cut furrow the width of which can never exceed the space between the furrow wheel and the coulter measured along the axle of the former; varying this space by shifting the wheel more to the right or left, the width of the furrow-slice can be regulated. The small or land-wheel runs on the top of the land. As the difference in level between the lowermost parts of the two wheels represents the depth of the ploughing, it can be regulated by raising or lowering this wheel. A plough with two such wheels is suitable for level lands or lands nearly so, and when once set, it will run almost without holding. Ploughs are also made with one or no wheel for ploughing unlevel and sticky soils, but they require more skill in the ploughman who has no guide for the width, or in case of no wheel, for both width and depth of ploughing.

With modern improved ploughs, furrows from six to fourteen inches wide and from four to fourteen inches deep can be cut. Great discretion is necessary to decide upon, according to the nature of the soil and the crop to be sown, the size of the furrow which will give the best result and at the same time the most economical for work. It is impossible here for me to lay down any fixed rules for determining the most suitable width and depth of furrows in every case, but I shall endeavour to throw in some hints which will help the practical farmer in deciding upon the proper size of the furrows. If the surface soil be extremely poor, the subsoil rich and manure costly or not easily procurable, deep ploughing is necessary; so also when there is much fear of long droughts and irrigation too costly to pay. Little arithmetic is necesary to understand that wider the furrow less the distance to be travelled by the cattle to plough a griven area of land; when the cattle are drawing a plough or any other load behind them, the power (energy) given out by them goes partly to overcome the resistance due to the useful work, as in case of ploughing in cutting and turning the furrow slices; and partly in dragging the plough itself and their own weight. The latter portion of the energy mechanically speaking is not doing any useful work and consequently wasted; so if the width of the furrow be fixed less than what it conveniently could be, the ratio of the useful work done to the amount of energy spent in ploughing a given area of land will be less than what it could be, in other words, it means the work will be less economical or more costly. It is easy to calculate from this how wastefully the operation of ploughing is carried on in this country when it is said that the average width of the indentation or groove made by the country-plough is about three to four inches, and that the same cattle with an improved plough can cut and turn a furrow six inches wide by five inches in depth. In an experiment personally conducted by the writer, it was found that with an improved plough an ordinary team could plough five inches deep a plot of land measuring quarter of an acre; the soil was as efficiently broken up as could not be done under three ploughings with the ordinary plough of the country.

To increase the efficiency, that is, to obtain the greatest amount of work out of a given quantity of energy spent, various means have been deviced by agricultural engineers but none succeeded better than the working of ploughs by steam-power supplied by an engine or engines placed at some convenient distance from the implement, but as I hope to take up the subject of steam-ploughing it is not necessary to say any more of it here than bare mentioning.

B. PALCHAUDHURI M. I. & S. I.

FIG. III.



CARDAMOM BLEACHING.

In the Gazetteer for the Dharwar District of Bombay p. 727, it is stated that Haveri, a town on the Dharwar Harihar Road, "has a small well of "brackish water impregnated with lime and possess-"ing good bleaching properties. The bales of car-"damoms imported from Kanara are unpacked and "washed in the water of this well. When dry the "husks become of a light cream colour."

I was encamped at Haveri in February last and was fortunate enough to see the whole process. This I propose to describe in detail in the hope that it may interest the readers of the "Indian Agricultural Gazette" and that some explanation of the peculiar virtue of the well may be eventually made.

The growth of cardamoms in the beautiful hill-gardens of north Kanara is described in Mr. J. M. Campbell's Gazetteer (Kanara, volume XV., Part II, Page 9.) As a rule the only preparation for the market consists in sun-drying the cardamoms picked in September or October. They are placed on mats, which are hung on poles and put out of doors during the day but brought into the house at night. Usually four days are required to complete the drying. The cardamoms are then ready for sale. But a large proportion of the cardamoms produced in Kanara are taken to Haveri to be bleached with the aid of the water of the famous well. The local taste appears to prefer them unbleached. But a good market is found for "doctored" cardamoms as far as Bombay and Bangalore. I believe that the process does more than bleach. It softens the pungency and improves the flavour.

The Haveri well which has or is supposed to have the peculiar virtues belongs to a Jangam or Lingait priest. He makes no charge for its use, though it is said that he receives occasional voluntary presents from the cardamom-dealers. The water of the well is freely drawn by all comers for ordinary household purposes.

The Process.—Water from the well is drawn and taken to a suitable room. A large earthenware vessel is filled with the water, into which pounded *Autalkai* (the fruit of the Soapnut, *Sapindus emarginatus*) and *Sikekai* (*Accacia concinna*) in the proportions of 2 lbs. of the former to ¼ of the latter for about 5 gallons of the water, are placed and well stirred. Another vessel contains a strong solution of common soap in the water of the well.

The mixture containing 2 lbs. of pounded soapnut and ¼ of *Sikekai* suffices for 5 *mans* (1 *man*= 26 lbs.)of cardamoms.

Two women seated on tripods place a widemouthed earthenware vessel between them, the washing tub as it may be styled. Eight lotafuls of the well-water, a large supply of which is kept at hand are poured into the tub and three lotafuls of the *soapnut Sikekai* mixture. The lota holds about one quart of water.

The tub then receives a basketful of cardamoms weighing 10lbs. The two women plunge their hands into the tub and stir vigorously for about one minute and then suddenly rest for about the same length of time and again stir for another minute. A thick lather results. This completes the first washing. The cardamoms are baled out by hand and transferred to a basket where they remain a few seconds till the water has drained off. The basketful is received by two other women sitting on tripods with a washing tub between them. This tub contains 7 quarts of the pure water, one of the *soapnut* and *Sikekai* mixture, and one of the soap solution. The cardamoms are stirred as in the first washing, with the same interval of rest, and are baled out into another basket; when the water is drained off, the washed cardamoms are thrown on to a mat. The heap becomes large after a few hours work. A woman is exclusively in charge of it and continually sprinkles the well-water over it. She is relieved at night by another woman, who sprinkles the heap till morning once every half hour.

Next day when the sun has risen the heap is carried to the flat roof of the house and the cardamoms are spread on mats for 4 or 5 hours to dry. The next operation is to nip off the short stalks. This is done by women, sitting in the house. Each woman has a large pair of English scissors. She squats on the floor and rests her right hand which holds the scissors on the floor and feeds the scissors with her left hand. The pace at which this nipping is done astonished me. The stalk is very small and care must be taken to cut it off without injury to the cardamom itself. I saw an old woman nip 90 cardamoms in one minute.

This done the sorting begins. The small illshapen cardamoms are separated and only the well rounded ones packed for export to distant markets. A woman sorts a *man* per diem. I must now return to the first washing. The mixture in the tub after the first basketful has been baled out is replenished by 2 or 3 quarts of the well-water and a second basketful washed. The tub is then emptied and a fresh mixture made. The mixture for the 2nd washing also does duty for 2 basketfuls. The women who wash the cardamoms are paid 3 annas per diem, an ordinary wage is 1½ to 2 annas. The night-watcher receives 4 annas. The nipping is paid for by the piece, at the rate of ½ anna per *padi*

(10 *padis*=1 *man*=26 lbs.) It is said that an expert can earn 2½ annas per diem. She must clip 18 lbs. therefore. All other hands employed are paid by the day, at 2 annas.

Haveri is a Municipal town. I was told that for a time an octroi duty on cardamoms was levied. It was however wisely withdrawn, for it was found that the cardamom trade was checked, and that the tax was evaded by taking water outside the limits of the municipality. It is difficult to ascertain the amount of cardamoms which are brought from Kanara to the Haveri well. But the villagers assured me that at least 2,000 *mans* (23 tons) come for the washing annually.

The question is whether this well has really the virtues which it is supposed to have of bleaching and improving the flavour of cardamoms, or is the whole process an instance of superstition. I bottled some of the water and carried away some of the soapnut and *sikekai*, but I found that the well-water had already been subjected to analysis. It will be more satisfactory for me to reproduce the report of the Chemical analyser to Government of which he has kindly favoured me with a copy.

"I have examined a sample of water stated to be " a specimen of that used at Haveri for washing car- " damoms. The samples yielded to analysis the results " shown below. I was unable to detect in the water " the presence of any special constituent such as " would account for the reputation stated to be pos- " sessed by it of being a water specially suited for " washing cardamoms."

Analysis.	*Grains per Gallon.*
Total solids by evaporation	427·00
Chlorine	110·60
Sulphuric acid	36·38
Silica	2·59
Alumina	4·27
Lime	60·20
Magnesia	34·44

(Signed, C. J. B. Lyon F. C. S., F. I. C., Surgeon Major, Chemical Analyser to Government.)

Now it must be carefully borne in mind that the water of the well is not used alone, soapnut, *Sikekai* and soap are brought into its aid. I propose to send a copy of this article to Dr. Lyon in order that he may learn the details of the process; meanwhile I intend to have a practical experiment carried out. I shall have a few pounds of cardamoms, say one basketful, washed by the process above described, and another basketful subjected to an exactly similar process with the difference that water not from the Haveri well shall be used.

The chemical explanation of the process and its results, I think any one will admit, must be exceedingly difficult. As far as I know, no analyses of *autalkai* and *sikekai* have ever been published. It would not be worth the expense to have such analyses made, when the only object is to ascertain whether or not the Haveri well is a humbug.

Your readers will have the opportunity of seeing washed and unwashed cardamoms and the ingredients for washing in the Bombay exhibition but meanwhile I shall be happy to send samples to any one who will undertake to investigate the phenomenon.

E. C. OZANNE, C. S., M. R. A. C.

Director of Agriculture, Bombay.

NOTE.—The estimation of the amounts of (1) ammonia, (2) of organic matter, (3) of nitrogen existing as nitrites and nitrates, (4) of chlorine, (5) of total soluble and suspended matter, (6) of the hardness, and (7) of the presence or absence of lead affords the principal data in determining the value of a sample of water for domestic supply. Of ammonia bad well-water sometimes contains as much as 0·5 to 1 part in 100,000 parts, such undue proportion of it denoting contamination with sewage which may contain 2 to 10 parts of ammonia in 100,000 parts of liquid. Of chlorine present in well-waters the quantity is very variable. When contaminated with sewage, they may contain as much as 2 to 8 parts in 100,000 parts. Water originating from springs in the neighbourhood of the sea, especially if the distrtict be sandy, may contain considerable amount of chlorine and yet be free from sewage matter. Chlorine remains in state of combination with sodium, potassium and magnesium. When the water of a well as in the present case is used for washing of any kind, it is of great importance to determine the quantity of calcium and magnesium sulphates and carbonates as it is these compounds which make the water permanently or temporarily hard and exercise soap-destroying powers.

—ED. I. A. G.

NEWS.

The judges of the late Agricultural Exhibition at Dumraon have issued their decision and awarded the first prize of Rs. 50 to the "Kaisar" plough exhibited by the Government Farm at Kanpur, the price of which is only Rs 6. The first prize of Rs. 28 for country made ploughs was given to Jone's "Kashthar" plough exhibited by Messrs. Burrows & Co., and costing Rs. 7; while the second prize of Rs. 20 in this class was given to the Saidapet Farm plough, the price of which is Rs. 6. All these ploughs were apparently drawn with care by a small weak pair of bullocks but the trials it must be added took place in a light soil.

In September last a suggestion was mooted by the Director of Public Instruction, Madras, as to whether the establishment of a school of Forestry at

Saidapet would be desirable. The Forest Conservators being consulted expressed themselves averse to such a measure, the place being not in the neighbourhood of any forest and the present system of sending students to the Imperial Forest school at Dehra-Dun being incapable of improvement. The Board of Revenue also hold the same views.

A new appointment has been created in Madras *viz.* that of a Government mineralogist. Mr. Bosworth Smith has been appointed to this post on a salary of Rs. 500 per meusem and a travelling allowance of Rs. 250.

The Madras Government have in view the organization of a Botanical Department. There is one Botanical Institution in India which from its scientific traditions and the splendour of its maintenance may rank as imperial. This is the Royal Botanical garden at Calcutta. The garden at Shaharunpur is another such institution of second order. India owes in great part to the Calcutta Botanical Department its chincona enterprize and to Shaharunpur its practical inception of tea cultivation though the initiatory stages must be credited to the Calcutta Botanists.

The hottest day in Calcutta during the month of April last was the 15th when the thermometer stood at 105° and the coldest day was on the 26th when it fell to 69·6°.

Apart from Government Stores the total imports from India during the year 1884-85 amount to Rs. 53, 14, 79, 198, as compared with Rs. 52, 70, 38, 912 for last year, while the exports for the two periods are Rs. 83, 11, 54, 429, and Rs. 88, 03, 36, 847, respectively. The exports are thus 492 lakhs less than those of 1883-84, which however was an exceptionally prosperous year.

There are at present 7 paper mills in India; three in the Presidency of Bombay, one at Lucknow, one at Gwalior, and two in Bengal. Of the two mills in Bengal, the Balli Mill scored the largest amount in 1883. Its outturn in that year was 5,447,680lbs valued at Rs. 6,00 000. Next to Balli came the Gwalior mill, which made 1,048,320lbs valued at Rs. 1,08,125. The kind of paper turned out by these Mills is coarse, and fine paper has yet to be indented from England and the continent of Europe, so there is yet room for enterprise and improvement.

There are now about 80,000 acres of land under tea in Ceylon.

There is a water famine in Bangalore.

The condition of crops in main parts of Madras, owing to the long continued drought, is causing same anxiety to the local Government.

The cadastral revenue survey of British Burma is reported to have resulted in an increase of the land revenue of that province.

A scarcity of water prevails on some portion of the line of the Nizam's State Railway which has caused almost block in the traffic.

A local paper mentions that several planters are throwing up their concerns in Travancore owing to the failure of coffee.

A committee, appointed by Government to consider the subject of cattle breeding is to assemble at Simla during the present month.

The latest news from the indigo districts is that good rain has fallen throughout Tirhut and Champaran, which has enabled planters to fill up their empty lands. In Chapra, although the rain has not been so heavy or so general, prospects have materially improved, and the planters still entertain hopes of a good season. Rain has fallen generally throughout most of the Bengal districts, but more is still required in Midnapur, and would, in fact, be generally acceptable. The advices from the North West Provinces are not so favourable.

Foot and mouth disease has broken out amongst the seize train bullocks at Ferozepur.

The industry in coffee all over the Nilgiris is greatly depressed and valuable properties are going abegging.

Preparations are being made for the cadastral survey of Mozufferpur, and for the institution of agricultural improvements in the Burdwan Division and in some district of Behar.

The reduction of railway freight on fibrous materials has stimulated paper makers to use grass and other fibrous materials existing abundantly in India. There is a grass called *babui* (Pollenia eriopoda) which grows largely in many parts of Bengal, N. W. Provinces and Nepal which the people of the country use for making strong ropes and strings. The Balli mills used in 1883, 2,500 maunds and in 1884, 15,500 maunds of this grass. The use of the grass may, however, be said to have only been beginning. It grows over large tracts of country and its extended use as a paper making fibre ought to be a powerful stimulus to our paper making industry.

The exports of new season's tea from Canton up to the 21st April amounted to 378,074 lbs as compared with 712, 332 lbs. exported up to the same date last year.

The average outturn of wheat in South Australia is calculated to be not more than 9 bushels or a little over 6 maunds per acre, the best tracts not yielding more than 10 to 12 maunds.

The Director of Revenue Settlement and Agriculture, Madras, has made a proposal that the prize at Agricultural Exhibitions might, take the shape of stock and of suitable agricultural implements. The proposal has been sent with the Board's sanction for the consideration of the Government.

It has recently been made public that the Indian Linseed oil is richer in quality than the Russian oil though the latter is superior in drying quality. For this defect Calcutta-seed-oil sells at £19 to £19 10s. per ton whilst the Baltic seed-oil is selling in English market at £23 10s. to £24 per ton. In view of this, the Madras Government at the instance of the Secretary of State have directed inquiries to be instituted for determining—(1) the cause of the richer quality of the Indian article and (2) how the Indian oil might be assimilated in quality to that which is in demand for the special trade indicated and for painter's work generally for which a good drying oil is essential.

Last year for the first time, the import trade of Bombay actually exceeded that of Bengal; the total value, being 21 crores 51 lakhs, against 21 crores 43 lakhs from the latter Presidency. The export trade is rapidly following a similar course; the figures last

year having been—Bengal 32 crores 83 lakhs, Bombay 32 crores 63 lakhs, which is the smallest difference yet attained. Calcutta, with its longer sea voyage, the tortuous course of the Hooghly, and heavier shipping charges, finds it hard to contend with Bombay. To what extent the Central Provinces Railway may give a fresh impetus to the trade of Calcutta, remains to be seen; but certain it is, that if the capital of India is not to be outstripped by the sister Presidency, some aid of this description must come to the rescue.

The value of horses imported from Persia, Australia, and other countries, was Rs. 20, 16, 894, almost the same as in the previous year; while the value of other animals amounted to only Rs. 59, 193. Teetotallers will be glad to know that the imports of *beer* fell from over 30 to 24 lakhs, *spirits* from 68 to 63 lakhs, and *wines* and *liqueurs* from 40 to 33½ lakhs. With regard to ornaments, few persons are probably aware that "*chanks*," or large ornamental shells, are annually imported to the value of nearly three lakhs of rupees. Couries reached the value of one lakh. Turning to exports, it may throw some light on the silk industry, to note that the export of *raw silk* during last year was 531,205 lbs., and that the value of raw silk during the last three years has been 44,52½ and 37 lakhs. The waste silk and cocoons shipped annually also average ten lakhs, so that the trade cannot altogether be considered an insignificant one. One would hardly suppose that milk and butter were produced in lavishly superfluous quantities in this country, yet the export of *ghee* last year was 1,572, 415 lbs. valued at Rs. 5,72,420. Complaints have not infrequently been made, that *birds* were being exterminated for the sake of their plumage, especially in the southern Presidency. That these are not unfounded, will be readily believed, when it is found that feathers have been shipped of late years, to the extent of about 100,000 lbs. annually, valued at more than six lakhs of rupees. The Bombay presidency stands high at the top of the list for imports and exports, both Indian and Foreign. The trade, however, has been decreasing of late years. Bengal, Madras, British Burmah and Sindh follow next in order.

The total number of persons killed by snakes and wild animals in Bengal, during five years ending 1883, is given in the subjoined table :—

	1879	1880	1881	1882	1883
Killed by wild animals	1,264	1,295	1,367	1,267	1,302
Killed by snakes .	9,515	10,064	9,268	9,191	9,153
Total...	10,799	11,359	10,635	10,458	10,455

Some Experiments were made last year at the Kanhpur Model Farm, which has now been styled the "Cawnpore Agricultural Station," in the preparation of ensilage. The experiments were tried on a rather extensive scale, there being no less than ten earthen pits and three masonry pits filled. The crops made use of were juar, sorgham, guinea grass, and common grass. The grasses were cut just as they were growing into flower, the sorgham and part of the juar were cut when the cobs were fully formed, and ripe enough to allow of their being cut and stored; the stalks were quite green, although they had lost a good deal of their moisture. The juar, sorgham, and a portion of the guinea grass were cut into chaff before packing, whilst the common grass was put in whole. The earthen pits were nearly all circular in form, a little broader at the top than at the bottom, so as to give a slight slope to the walls. Seven of the earthen pits were covered with chappas to protect them against the rain, and over three others a sloping mound of earth, three feet high, was made. In the case of the larger pits, an opening was cut at one of the sides to allow of the entrance of a bullock to tread down the stuff. The silos were filled in layers, each layer after it had been trodden down being sprinkled over with a little salt and covered over with bhusi to the depth of about two inches. The final layer, after being pressed down was covered with earth to the depth of two or three feet. A circular silo, ten feet in diameter, and only six feet in depth, cost altogether for ensilaging 171 maunds of juar, Rs. 9-15-6, which may be divided as follows:—Cost of digging Rs. 0-12-0, of chappa for covering Rs 2-8-0, of cutting into chaff Rs. 5-3-6, of filling, treading down, and weighting Rs. 1-8. Another experiment in ensilaging 725 maunds of common grass in an elliptical silo, 18 feet in diameter and 10 feet in depth, cost Rs. 34-14-9, and considering the amount of stuff that is produced by it, it appears to be the cheapest method of obtaining fodder.

We hear from Cachar that, although the tea in some parts is doing well, in others red spider and blight are rapidly increasing.

In Nipal, up to the 14th of May, the weather had been stormy and cool. The health of the people was good, but the prospects of the crops were only fair.

It is reported that the whole of the mining rights in the Nizam's dominions have been leased to an English company, supposed to be Messrs. Watson, Stewart, and Co.

In the Bombay Health Officer's report for the 4th quarter of 1884, exclusive of still-born, 5,715 deaths were registered, being 6 more than in the third quarter of the year and 842 more than in the corresponding period of last year.

The rate of mortality of the chief races is shown in the table below :—

	Annual rate per 1,000 of population
Hindoos	28·07
Hindoos, low-caste	33·95
Mussulmans	35·36
Parsees	21·64
Europeans	34·49

The infant mortality under 5 years of age is 532 less than in the third quarter; 2,183 children under 5 years of age died. The infant mortality is exhibited in the following table :—

Under 1 year	1,509
" 2 years	366
" 3 "	151
" 4 "	96
" 5 "	61

At the burying and burning grounds of this city 4,043 bodies were buried, and 1,796 burnt, and 297 were conveyed to the Towers of Silence. 3,962 living—2,089 males and 1,873 females—and 421 still-born births were registered; the birth-rate is equal to 19·19 per 1,000 of population.

Last year the total of the merchant navy on the register for the United Kingdom is returned at 7,166,401 tons, and for the whole of the British Empire it amounted to 9,131,418 tons. This is an increase on the previous year of 287,751 tons and 334,901 tons, respectively. The navies of the other maritime Powers, on the other hand, make little or no progress. The United States, which has the next largest merchant navy, has 1,302,095 tons registered for foreign trade, and 2,933,892 tons employed in the river, lake, and home trade. Totals of other countries, 1883, were—German Empire, 1,226,650 tons; Italy, 990,004 tons; and France, 983,017 tons.

COMMERCIAL INTELLIGENCE.

An Analysis of Bombay Market Report for the month of May.

In the first week there was no abatement of anxiety regarding political affairs. The *Government Paper* declined from Rs. 92½ to Rs. 90½ for 4 per cents. *Cotton* had shown dulluess amounting to depression with short demand and limited supply. *Seeds* and *wheats* had strengthened. *Imports* were very dull excepting coal. The off-take of *piece-goods* was under average and prices had a tendency to go down. *Freights* were very firm at about 28s. 9*d.* to 30s. per ton for May loading. *Money* was becoming very tight and promised to interfere seriously with business.

In the second week the aspect of political affairs grew more pacific. The effect in English markets was to raise the *consols* from 95½ to 98¾, to improve the position of *cotton* and kindred markets and to depress *seeds*, *wheat* and other articles of Russian production. Extreme tightness in money market continued and interfered seriously with business. In *exports* the situation was bad and in *imports* not much better. The demand for *piece-goods* continued slack, telling adversely upon weaving and spinning mills. *Freights* weakened materially in sympathy not only with less favourable prospects for shipment of *wheat* and *seeds* but with the certainty that Government demand for transports had come to an end. Taking it all round business developed little from the peaceful turn of politics.

In the third week with the probable settlement of the Afghan complications, business assumed more confident tone; *Government Paper* recovered 2½ per cent. and other securities in proportion. *Exports* and *Imports* however continued as slack as ever. *Money* was easier owing to large export of silver and gold; exchange for the same reason declined ¼*d.* per rupee. *Freights* were steady at 27*s.* 6*d.* to 28*s.* 9*d.* per ton for steamers. The earnings of the G. I. P. railway for the week were the largest on record.

In the fourth week, the reported hitch in the negotiations with Russia which had been made known here by telegraph on the evening of last mail day course some irregularity to Government Paper, but otherwise there has been nothing to interfere with the ordinary course of business. Arrivals of produce were no doubt large and shipments of *wheat* and *seeds* proportionally extensive. In *cotton* the position is contradictory. *Freights* are fairly active; 26*s.* 3*d.* to 27*s.* 6*d.* being the current figures for early loading and 25*s.* to 26*s.* 3*d.* for later on. *Exchange* underwent almost daily fluctuations and rose ⅛*d.* to ¼*d.* per rupee lower on the week. Shares had been active and tending upwards.

EXTRACTS.

THE SEWAGE OF LONDON.

The following is the greater portion of the letter by Sir J. B. Lawes on this subject. He points out, as an obvious truth, that, in order to any manufacture whatever, there must be raw material provided. This is a truth which applies to all produce, whether vegetable or animal—to the "manufacture," in fact, of the fishes of the sea, as well as that of the fruits of the earth:—

The question as to what extent the fish annually taken from the sea that surrounds our coasts are directly or indirectly supported by the sewage and *debris* carried down by our rivers is somewhat difficult to answer. I propose to bring forward such evidence as we possess, and then leave your readers to form their own conclusions on the subject. In Pofessor Huxley's address given at the Fisheries Exhibition at South Kensington he pointed out the superior productive powers of a given area of the sea, in fish, to those of an equal area of arable land, or pasture, in the production of corn or meat. Professor Huxley estimates that "once in a year an acre of good land will produce one ton of corn, or two or three hundredweights of meat or cheese, while an acre of sea-bottom in the best fishing grounds yields a greater weight of fish every week in the year." The chemical composition of fish does not differ much in some of their most important ingredients from that of the stock fed on our farms. In

1,000 lbs. of sprats, Professor Way found 20 parts of nitrogen $8\frac{1}{4}$ of phosphoric acid, and $4\frac{1}{2}$ of potash In the animals of the farm at Rothamsted, we found about 20 parts of nitrogen, 10 to 12 parts of phosphoric acid, and $1\frac{1}{2}$ of potash. Although varying in their relative proportions, it will be observed that these important ingredients are almost the same in fish as in cattle or sheep, amounting in each case to about 33 parts in 1,000. Of fat or oil the sprat contains about 19 per cent. which is much the same as the amount we found in a store sheep or ox; but in the case of the animals this amount is considerably increased by the time the stock is fit for the butcher. The valuable library of fish literature which had its origin in the South Kensington Exhibition contains a great deal of information regarding the food of fish. We learn that they are carnivorous, and that the big fish prey upon those which are smaller. In the report of the Rivers Pollution Commission, Professor Frankland speaks of organisms so small as to pass through the finest filters; the sea, therefore, appears to contain alike the most gigantic and the most minute forms of life. In the case of agriculture long experience has shown that exhausted soils can be restored to fertility by the application of manures, and, as I mentioned above, Professor Huxley speaks of an acre of good land yielding as much as a ton of corn. At Rothamsted, by a very liberal application of nitrogen phosphoric acid, and potash, we have grown about this amount of wheat on one of our fields for 40 years in succession; but Professor Huxley speaks of an acre of the best fishery ground yielding a like weight in fish every week. What, then, is the source of this vast amount of manure ingredients which is taken out of the sea apparently without restoration?

Before referring to the source of the food of sea-fish, I will say a few words on the sources of food for fish in rivers and lakes. Fish have one great advantage over animals from their not using up a large amount of food in merely keeping up the temperature of the body; but to increase in weight they require a supply of nitrogen, phosphoric acid, and potash, which substances must be obtained either from the water or from the bed of the river or lake. If the source of the river is uncultivated, or consists of rocky or peaty ground, and the bed of the river or lake is likewise rock it will be useless to look for an abundance of fish. In the report of the Rivers Pollution Commission we are furnished with analyses of almost every river and lake in Great Britain. The rivers which have their source in the Highlands of Scotland frequently contain no nitric acid; there is nothing to support an aquatic vegetation, or the animalculæ which live upon it and consequently there is but little food for the fish. It is true that a considerable number of salmon are found in some of these rivers at certain periods of the year, but it is well known that they take little or no food, as they go up for the purpose of spawning, and lose considerably in weight during the process; this, therefore, is quite a different case. As a matter of fact, many of the most beautiful lakes and rivers in Scotland are very bare of fish. In a district with which I am well acquainted in the Highlands there are a number of small streams containing trout which rarely exceed one or two ounces in weight. In two of these streams, however, much larger fish are taken. One receives the drainage from a kennel of dogs, and the other the drainage from a highly manured potato field. Close to where I reside in Hertfordshire, the Ver, or Colne has its origin in the chalk. The bed of the river is just now quite dry owing to the low rainfall, but trout will grow to four or five pounds in weight, although, as a rule there is hardly water enough to cover their backs. The water in in this stream springs from the chalk; it contains an abundance of nitric acid, and is celebrated for the water-cresses which are grown for the market in large quantities. These are manured with superphosphate lime, and if ever the cultivation of fish becomes a trade in England, this phosphate will play an important part in increasing their production. Sewage must, therefore, largely increase the production of fish, provided that it is sufficiently diluted, and does not interfere with their health. In rivers and lakes, a knowledge both of the ingredients contained in the soil which forms the bed of the water, as also of water, will give tolerably correct information regarding its capability to produce fish.

When, however, we come to the consideration of the fish-producing properties of the sea, we have to deal with a problem of far greater complications and uncertainties. In the valuable map constructed by Vice-Admiral His Royal Highness the Duke of Edinburgh, K. G., we are informed that 471,000 tons of fish are caught on the east coast of Scotland and England; 117,534 tons on the south coast of England; but only 37,405 tons on the west coasts of England, Scotland, and all Ireland. It appears, therefore, that about 96 per cent. of the fish are caught between Wick and the Land's End although the coast line must be very much less than that which extends from the north of Scotland to the Land's End, including the circuit of Ireland. So long as fish live upon each other, the sea much resembles a soil covered by a forest untouched by man. Cod fish eat herrings, and they in their turn eat smaller fish; but there is no exhaustion of ingredients. When, however, over 600,000 tons are removed from a given area of water by our own fishermen, while, in addition, large quantities are taken by the fisher-

men of other nations, the source of this vast amount—of what in agriculture we shoulddescribe as fertility—becomes an interesting question. About one-half of the whole of the fish captured consists of herrings; and, as in their chemical composition, they much resemble sprats. I will take the analysis of sprats for my basis. I find that of the three substances nitrogen, phosphoric acid, and potash—the removal of which in crops or stock impoverishes our soils—about 21,000 tons, are removed in the fish every year. The amount of these three substances carried down into the sea in the London sewage every year collectively largely exceeds the amount removed by the fish. But while this excess is considerably greater in the nitrogen, as regards phosphoric acid—a substance so essential in the formation of the bone—the sewage contains less than that removed by the fish. There can be no doubt that the estuary of the Thames, if it does not entirely feed the mature fish, is the breeding ground of innumerable shoals of what may be called more especially the poor man's fish—the sprat and the herring. It is thought by some that sea water alone is competent to furnish all the food which fish require. If this were so, we might expect the fishing ground upon the west of England or the coasts of Ireland would be as productive as that on the east and south of England; but such is not the case. There can be no doubt that the character of the soil at the bed of the sea must vary, just as much as the character of the soil of a field varies. As a matter of fact, a rocky bottom could not support the life which a rich soil can feed, and it is probable that some parts of the North Sea may possess an exceptionally fertile soil. It is evident, however, that the *debris* and sewage from the various rivers which run into the sea, on the east of Scotland and England furnish a much larger amount of fertilising ingredients than are removed in the fish, and that so long as the present discharge is continued, the increase which takes place in the yield of fish each year is likey to be maintained. A great number of analyses of sea-water has been published, but in no one instance can I find the amount of phosphoric acid given. In the 77 analyses of sea-water collected during the Challenger expedition, and recently published by Professor M. Dittmar, phosphoric acid is not noticed; and the late Professor Voelcker stated that the sea-water contained a mere trace of it. But to suppose that some thousand tons of this most essential ingredient in animal and vegetable life is without a most potent influence in the production of the food of fish, as well as of the fish themselves, would be almost equivalent to denying the influence of sewage upon our fields.

There has been a very prevalent opinion that the sewage of London has been wasted. The evidence which I have brought forward will, I venture to hope, not only do away with this impression, but will also establish the fact that it has a decided influence on the production of fish. The absolute amount of this influence, however, is a question on which every one can form his own opinion. We have as a fact that the sewage of the Thames restores to the sea much more than the whole of some, and the greater portion of other, important manure ingredients which are annually taken out of it by our fishermen His Royal Highness, the Duke of Edinburgh, in his address at the South Kensington Fisheries Exhibition, estimated the annual value of our fish as between 7 and 8½ millions. In the event of a large expenditure being incurred in removing the sewage nearer to, or into the sea, the ratepayers of the metropolis might possibly expect that some portion of the cost would be paid from the national purse, on the plea of their contributing so largely to the food of the fish The Agricultural Holdings Act gives compensation for unexhausted fertility; but I fear that no provision has been made for compensation in the case of sewage which is discharged into the sea.—*Scottish Agricultural Gazette.*

The Advantages of a Knowledge of Veterinary Science to an Agriculturist.

What could the farmer do without his cattle? They plough his land, raise his water for irrigation purposes, produce manure to fertilize the soil, cart his grain and straw to the market, and serve him in many other ways too numerous to mention. In short, the Indian agriculturist is entirely dependent upon his cattle for his daily bread. If the ryot's cattle die from disease, or if they depreciate from want of food he is not the only loser. The revenue also must suffer. Rice, the staple food of the people of not only India but of the various parts of the globe to which it is exported, becomes a dear commodity, and thus we have all the attendant miseries of scarcity and high prices. Therefore the careful preservation of the cattle of this presidency is of no mean importance. It is its main wealth, and should be scrupulously regarded as such. It will probably be not uninteresting to you to know the enormous loss which takes place annually in this Presidency from the ravages of animal plagues. Since the formation of the Cattle Disease Inspection Department, statistics have been collected, and the loss in live-stock from the 1st of September 1882 to the 31st of December 1884, a space of two years and four months, has been seventy thousand and sixty-six, showing a

money value of one million, five hundred and ninety-one thousand, six hundred and eighty rupees, or one hundred and twenty-seven thousand, three hundred and thirty-four pounds sterling, which is a very serious matter. These figures must be taken to represent only a fraction of the actual loss this Presidency sustained during the period referred to; for I have known, and have reasons to believe, that owing to the indifference on the part of the village officers and of cattle owners, a large number of deaths among live-stock are never reported. But I am happy to be able to state that during the last official year the death-rate was 17 per cent. less than in the previous one. The Department as at present constituted cannot be expected to do very much, considering the vast area of the Presidency, 150,000 square miles, with a strength in live-stock of seventeen millions, eight hundred and forty-five thousand, five hundred and seventy-six. This does not include Zemindary and Inam lands.—*From the address of Sir Charles Turner, Chief Justice of Madras at the Anniversary of the Saidapet Agricultural College.* [to be continued—

Agricultural and Horticultural Society of India.

Rice pest.—At the last ordinary general meeting of the Society, Mr. Wood-Mason, in view of the wide interest in the subject, read a report on an insect pest which affects paddy *viz.* the "Palan Byoo" or "Teindoung Bo" (*Parapenya Oryzalis*) a lepidopterous insect, which in the caterpillar stage breathes air dissolved in water by means of tracheal gills.

The "Gilla."—A communication was read then from Dr. Bonavia, Etawah, asking for information regarding the "gilla" He writes:—"Dhobis up here and probably also down in Bengal use a curious kind of *nut* for crimping linen, without using any crimping irons. The seed is of the size of a small and *fat* pocket-watch sides. Dhobis cut one side, and scoop out the kernal; then they introduce two fingers into the cavity, and quickly stroke the damp linen forwards with its polished surface. This crimps it beautifully *crossways*.

The Deputy Secretary stated that the seed to which Dr. Bonavia referred was that of the *Entada scandens* (Bentham), E. *pursætha* (D' C), the *Mimosa scandens* of Linn. and Roxb., a large climber common to many parts of the tropics, and found in Sylhet, Nepal, Ceylon, Java, the West Indies, etc. and used by the natives for washing the hair, and *Voigkt* (p. 256) says it is used by the ghaut people as an antifebrile. Drury mentions that it is employed as an emetic in Java. The seed is made into snuff-boxes in the West Indies, and according to Dr. Birdwood (Cat. of Vegetable Products of Bombay Presidency) "the pods are used by the police there." Although the pods are of great size, sometimes six feet and more long and 4 feet 5 inches broad, it seems a strange article for the police to use. Gamble says "the seeds are eaten after roasting and steeping in water, the kernels are used by the Nipalese for washing their hair, and in Bengal by washermen for crimping linen." The seed is sold in the bazar for medicinal purposes, and is used in a powdered form; it is administered as a stimulant: but this use is not mentioned by O'Shaughnessy or others. Dr. Watt, in his Economic Products of India, says that "an oil is made from the seed the properties of which are unknown." But the use made of it by the dhobis seems the most general.*

Early Amber Sorghum.— Messrs. Minchin Brothers & Co's report on the result of their experiment with this sorghum is interesting. It seems curious that hitherto all attempts to make crystallizable sugar from it in India should have failed, while in America it seems to be recognized as fit to replace sugarcane in many places.

The State of Season and Prospects of the Crops for the Week ending 8th April, 1885:

General Remarks.—The following remarks relate to the fortnight ending the 8th instant. In Madras the rainfall has been general, though light in most districts. From Mysore and Coorg, and most districts of the Bombay Presidency slight showers are reported. In the Punjab rain fell throughout the province, and slight showers are reported from two or three places in the Central Provinces and from several of the Central India and Rajputana States. In Bengal rain fell in a few districts, and in Assam the fall was general and in some districts heavy.

In Madras the standing crops continue generally fair. In Mysore prospects are not very promising at present; pasturage and water are scarce, and paddy and sugarcane are reported to be withering in parts.

In Bombay the *rabi* harvest has been completed in some districts, and is in active progress elsewhere. In the North-Western Provinces and Oudh, the Punjab, and the Central Provinces the *rabi* is also being cut, and prospects are generally good. The *rabi* harvest is also in progress in the Central India and Rajputana States and the Nizam's territories; in the Berars threshing is taking place. In Bengal the *rabi* harvest is well advanced; more rain is wanted for standing crops and for ploughing operations; sowing of early paddy has commenced in

*Note.—The seeds are very commonly used by the women all over Bengal during confinement.

places. A scarcity of drinking water is reported from Beerbhoom. The rain, which fell in Assam during the past fortnight, has been very beneficial to the standing crops; dry weather is, however, now needed to facilitate sowings. The prospects of the crops are generally good.

Small pox and cholera are prevalent in most provinces, but otherwise the public health is generally good.

Prices are generally steady, except in the Panjab and a few districts in Bengal, where they show a slight advance.

The State of Season and Prospects of the Crops for the Week ending 15th April 1885.

General Remarks — Slight showers have fallen throughout the Madras Presidency, Mysore, in several districts in Bombay, and the Central Provinces. In the North-Western Provinces and Oudh and the Punjab rain has fallen in a few districts. Light rain is also reported from some of the Central India and Rajputana States. In Bengal there has been rain in some districts, and in Assam the fall continues to be generally heavy.

In Madras the standing crops are generally in fair condition, but in Mysore prospects are reported to be still uncertain. In Coorg rain is much wanted for the coffee blossoms.

The *rabi* harvest has been nearly completed in most districts in the Bombay Presidency, and preparations for the *kharif* have commenced in places. Scarcity of drinking-water continues to exist in parts of Dharwar and Belgaum, and of fodder in parts of Dharwar.

In Central India and Rajputana harvesting is going on, and prospects are generally good. The *rabi* harvest has commenced in the Punjab, and promises well. In the North-Western Provinces and Oudh and the Central Provinces harvesting, threshing, and winnowing are in progress. In the former an average outturn is expected.

In Bengal the *rabi* harvest, which has been nearly completed, has yielded a good outturn on the whole. Ploughing is in progress and sowing of early paddy and jute has commenced in some places. Ploughing and sowing continue in Assam, and prospects are generally favourable.

Cholera and small-pox are reported from parts of Madras, Bombay, Bengal, the North-Western Provinces and Oudh, and British Burma; otherwise the the public health is generally good.

Prices are fluctuating in Bengal and the Punjab; elsewhere they are generally stationary.

The State of Season and Prospects of the Crops for the Week ending 22nd April 1885

General Remarks.—Slight rain has fallen in several districts in the Bombay Presidency and generally throughout the Panjab. In Bengal, the Central Provinces, and in the Central India and Rajputana States slight local showers have occurred. In Assam heavy rain continnse to fall.

Prospects remain unchanged in Madras, and the harvest yield is reported to be below the average in some districts. In Mysore prospects continue unfavourable.

In Bombay and the North-Western Provinces and Oudh the *rabi* or spring harvest is approaching completion and preparations for the *kharif* or autumn crop have begun in places. The *rabi* harvest is in active progress in the Punjab, and has been nearly completed in the Central Provinces, where threshing and winnowing are going on. In the Berars the *rabi* crops have been reaped, and preparations for the *kharif* are progressing. In the Central India and Rajputana States agricultural prospects are generally good.

Rain is much wanted in Bengal to faciltate agricultural oprations. Sowings continue in Assam, and prospects are on the whole favourable.

Cholera and small-pox are generally prevalent.

Prices are fluctuating in the Punjab, and show a tendency to rise in Bengal. In other Provinces they remain generally stationary.

The State of Season and Prospects of the Crops for the Week ending 29th April 1885.

General Remarks.—Slight rain has fallen in parts of Madras, Bombay, the Central Provinces, and British Burma. In the Punjab the rainfall has been general, except in a few districts. In Bengal rain fell in a dozen districts, but more is very urgently wanted throughout the Province. In Assam the fall has not been so heavy as in the two previous weeks.

Prospects remain unchanged in Madras, while in Mysore they are dependent on timely rainfall, fodder is scarce in the latter Province. In Coorg the crops are in good condition.

In parts of Bombay the *rabi* harvest is still in progress, and preparations for the *kharif* continue. Scarcity of drinking-water and of fodder exists in places. The *rabi* harvest has been nearly completed in the Central Provinces and in the North-Western Provinces and Oudh, and is in active progress in the Punjab. Threshing and winnowing are in hand in the two former Provinces, and *kharif* operations have also commenced. In Hyderabad the harvest

continues; and threshing has been completed in the Berars, where *kharif* preparations are taking place In the Central India and Rajputana States the harvest is over in some places and continues in others.

Agricultural operations are progressing unsatisfactorily in Bengal, owing to the want of rain; harvesting of *boro* paddy continues. In Assam sowings have been nearly completed, and prospects are generally good.

The existence of cholera, small-pox, and fever is reported from nearly all Provinces, though the public health is generally good.

Prices show a tendency to rise in Bengal, and are unsteady in the Punjab.

The Indian Wheat Crop.

The following memorandum, dated the 24th April, has been issued in the Department of Revenue and Agriculture:—

Speaking generally the prospects of the wheat crop as previously reported remained unchanged up to the end of March.

Complete statistics for the Punjab are not yet available, the wheat harvest of the province being, as explained in the last summary, later in ripening than that of other parts of India; but the information received shows that though in some districts the yield is expected to be below, in others it is likely to be above the average and that, on the whole the wheat outturn of the province will be quite up to that of previous years.

In the North-Western Provinces and Oudh the very favourable character of the weather during March has led to an improvement in the estimated outturn. The area under wheat is said to be 5,284,400 acres, which is in excess of the normal wheat area by 318,721 acres. Of this area about 1·06 per cent is expected to bear a full average crop. A crop estimated at 90 per cent of an average crop is expected on about 12 per cent of the area—and 84 per cent crop on about 53 per cent of the area, a three quarters crop on about 32·9 per cent, and a 66 per cent crop on the remainder. Taking the province as a whole, the outturn is expected to be about 82 per cent of an average crop, and the total outturn anticipated is 2,040,000 tons. The stocks in hand are supposed to amount to about 60,000 tons.

In the Central Provinces, notwithstanding injury done by rust in the northern districts, the prospects of the crop are still excellent. The area said to be under wheat (370,000 acres) is less than the reputed normal wheat area by about 200,000 acres, but the outturn is expected to be 817,857 tons, or 14,286 tons above the average. The export during March was about 14,282 tons, but that for the first week in April amounted to 5,357 tons.

In the Bombay Presidency and in the Berar prospects remained unchanged at the date of the report.

No fresh information has been received from any of the Native States.

The report on the prospects of the wheat crop in the North-Western Provinces and Oudh for the month of March, is as follows:—"Wheat area of the United Provinces for March is 5,284,404 acres, which is greater than the area reported for February by 18,085 acres, and greater than normal area by 318,721 acres. Taking normal area at 100, the area now under wheat in the United Provinces is 106, area under white wheat is 1,213,980 acres, area under red wheat is 2,010,239 acres, area under mixed red and white wheat is 2,060,185 acres. The month of March has been favourable with bright weather and westerly winds, and the prospects of the crops have decidely improved. Taking 100, to represent full avarage, the condition of the crop is as follows: 56,264 acres stand at 100; 641,323 acres at 90; 2,803,881 acres at 84; 1,740,481, acres at 75; 42,454 acres at 66. The gross outturn of one full average crop on the area as now ascertained, would be 2,500,000 tons. The present estimate of the season's crop is 2,040,000 tons, or 90,000 tons in excess of the February estimate. Taking 100 to denote the gross outturn to a full average crop, this season's crop stands according to the present estimate at 82." A later report gives the following additional information :—"Estimated gross outturn of the three sorts of wheat in the United Provinces on 1st April 60,000 tons."

The report for March 1885 on the prospects of the wheat crop in the Punjab, is as follows :—Complete statistics of the area under wheat are, however, not yet available, and some of the figures are still open to correction :—"The area under wheat in the Delhi, Guagaon, Hissar, Ferozepur, Rohtak, Simla, Jullundur, Hoshiarpur, Kangra, Amritsar, Sialkot, Lahore, Gujranwala, Jhelum, Gujrat, Shahpur, Multan, Jhang Muzaffargarph, Dera Ismail Khan Dera Ghazi Khan, Banu, and Kohat districts is shown to be 5,325,000 acres this year as against 5,250,000 acres last year. In the remaining districts, Karnal, Umballa, Ludhiana, Gurdaspur, Rawalpinde, Montomery, Hazara, and Peshawar, the estimates already received give 2,033,000 acres this year as against 9,050,000 acres last year, but accurate statistics have yet to be received for the latter. In the parts of Hissar, Jullunder, Amritsar, Lahore, Guzlanwala, Multan, Dera Ismail Khan, Dera Ghazi Khan and Banu, the character of yield is described as below average. In the rest yield is either average or above; a full average may be estimated for the province as a whole. Further details will be telegraphed on receipt of complete and accurate statistics."

The report for March 1885 on the prospects of the wheat crop in the Central Provinces is as follows :—"Prospects remain unchanged, except that in the Northern districts the injury from rust has proved larger than was anticipated. Total approximate area for the provinces is 3,700,000 acres against a normal of 3,900,000 acres. Of these Saugor and Damoh contain 700,000 acres, the Narbada Valley 1,200,000 acres, the Nagpur country, including the Seoni District, 700,000 acres, and Chattisgurh 450,000 acres. The total outturn, as roughly estimated is two million two hundred ninety thousand maunds against a normal of two million two hundred fifty thousand maunds. The export fell off during March, in which month it amounted to rather over four million maunds (?); but it shows sign of recovery, and in the first week of April reached 1,500,370 maunds (?). No information respecting stocks is available.

The report for March 1885 on the prospects of the wheat crop in the Berars is as follows :—"Wheat harvest over, area under crop eight hundred nineteen thousand thirty three acres, yield generally about the average, outturn estimated at twelve thousand tons including existing stocks; eighty five thousand tons may be estimated as available for export."

PRICES CURRENT OF FOOD-GRAINS THROUGHOUT INDIA FOR THE 2nd HALF OF [illegible]

QUANTITIES PER RUPEE IN SEERS OF 80 TOLAHS.

Provinces.	Districts.	Wheat.			Rice (best sort).			Rice (common).			Gram.			Firewood.			Salt. Wholesale prices per maund of 40 seers.			Salt. Retail.			Remarks.
		Present fortnight.	Past fortnight.	Corresponding fortnight of 1884.	Present fortnight.	Past fortnight.	Corresponding fortnight of 1884.	Present fortnight.	Past fortnight.	Corresponding fortnight of 1884.	Present fortnight.	Past fortnight.	Corresponding fortnight of 1884.	Present fortnight.	Past fortnight.	Corresponding fortnight of 1884.	Present fortnight.	Past fortnight.	Corresponding fortnight of 84.	Present fortnight.	Past fortnight.	Corresponding fortnight of 84.	
		S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	R. A. P.	R. A. P.	R. A. P.	S. Ch.	S. Ch.	S. Ch.	
Bengal.	Calcutta ...	16 0	16 0	16 0	7 8	8 4	8 0	10 0	11 6	13 0	19 0	19 0	18 10	90 0	90 0	100 0	2 12 0	2 12 0	2 12 0	13 4	13 4	13 0	
	Dacca ...	16 0	21 0	17 0	16 0	16 0	12 8	18 0	17 12	14 0	18 8	16 0	18 0	80 0	80 0	90 0	3 0 0	3 0 0	3 2 0	13 5e	13 2	12 8	
	Patna ...	21 0	21 0	22 8	10 8	10 8	11 0	17 8	21 0	14 0	24 0	24 0	24 8	120 0	100 0	100 0	3 0 0	3 0 0	2 14 0	12 0	12 0	10 8	
	Cuttack ...	15 12	21 0	19 11	13 2	13 2	13 2	18 6*	17 1	19 11	19 11	19 11	13 10	80 0	80 0	80 0	2 12 0	2 12 0	2 12 0	14 0	14 0	14 0	
	Hazáribágh ...	15 0	15 0	14 0	10 0	10 0	10 0	14 8	14 8	14 0	16 0	17 0	16 0	320 0	320 0	320 0	3 9 0	3 10 0	3 12 6	10 0z6	10 0	10 0	* Price of common rice ranges in the interior from 21 to 26·4 seers per rupee.
Assam.	Sylhet ...	11 0	10 0	13 4	12 12	12 0	11 4	18 12	19 0	15 0	...	...	16 0	108 0	108 0	108 0	...	...	3 4 0	12 8	12 8	12 8	
																	S. Ch.	S. Ch.	S. Ch.				
Bombay.	Bombay ...	12 0	11 13	10 10	7 8	7 10	7 8	10 11	11 4	11 7	21 1	19 12	17 1	72 13	68 4	60 15	14 5	14 5	14 6	12 9	12 9	12 9	e. In the Sub-divisions the retail prices of salt per rupee were :—Manickgunj 12 seers, Moonshigunj 12 seers 12-4/5 chittaks, and Naraingunj 13-14 seers.
	Poona ...	14 15	14 15	12 10	10 7	10 7	9 13	11 0	11 0	10 7	18 6	18 6	18 6	68 0	68 0	68 0	14 11	14 11	14 11	14 7	14 7	14 7	
	Karachi ...	14 0	14 5	13 13	9 0	8 8	8 0	15 0	15 0	14 0	18 0	17 0	19 0	85 0	85 0	90 0	17 8	16 13	17 11	16 0	16 0	17 0	
Madras.	Vizagapatam ...	20 0	19 8	12 0	9 0	9 6	11 3	10 11	10 11	13 10	28 2	27 8	54 8	93 5	93 5	93 5	15 3	15 3	15 3	14 10	14 0	14 0	z. 6. The retail price of salt at Charta was ten seers per rupee and at Kharrackdiha 12 seers.
	Madras ...	11 5	11 5	10 8	11 6	11 6	13 8	12 6	12 6	14 14	20 2	20 2	27 5	82 10	82 10	85 0	16 14	16 14	16 14	16 8	16 8	16 6	
	Trichinopoly ...	9 14	9 14	9 14	11 8	11 8	15 2	12 0	12 0	15 3	23 5	23 2	33 14	97 3	97 3	97 3	17 0	17 0	17 6	16 3	16 3	17 0	
Punjab.	Delhi ...	22 0	22 0	19 0	...	...	...	14 0	14 0	12 0	32 0	30 0	25 0	90 0	90 0	80 0	13 0	13 0	13 0	12 0	12 0	12 0	
	Lahore ...	24 0	23 0	25 0	...	...	...	12 0	12 0	12 0	32 0	30 0	40 0	90 0	90 0	80 0	15 0	15 0	15 0	14 0	14 0	14 0	
	Peshâwár ...	27 0	26 0	27 0	...	...	...	13 0	13 0	12 0	27 0	26 0	32 0	98 0	98 0	124 0	46 13	45 8	36 6	45 0	44 0	35 4	
C. P.	Jubbulpore ...	22 0	22 0	23 12	12 0	13 0	10 8	15 0	15 0	18 0	30 0	29 0	27 0	120 0	120 0	120 0	11 12	11 8	11 12	11 0	11 0	11 4	
	Sambalpur ...	26 4	29 4	24 8	22 12	22 12	26 4	28 0	29 12	52 8	19 1	19 8	19 8	125 0	125 0	125 0	11 0	8 13	11 0	9 11	10 14	10 0	
B. Burma.	Akyab ...	...	...	...	12 0	12 0	13 0	16 8	17 0	14 0	10 0	10 0	10 0	240 0	264 0	250 0	35 0	35 0	...	32 0	32 0	30 0	
	Rangoon Town ...	20 9	20 9	15 15	15 6	16 10	11 4	16 10	18 6	12 8	18 9	18 9	19 7	320 0	320 0	320 0	50 10	50 10	50 11	29 2	29 4	22 10	
	Moulmein Town &c., ...	9 0	9 0	9 0	11 8	11 8	10 8	13 8	13 8	13 8	13 8	13 8	13 8	220 0	220 0	220 0	30 15	30 15	30 8	30 8	30 8	20 15	
	Secunderabad ...	16 5	16 12	15 18	7 14	7 14	7 14	11 11	12 3	10 3	16 5	16 5	17 4	125 0	125 0	125 0	10 11	10 11	10 14	10 3	10 3	10 6	
	Mysore ...	10 0	10 0	10 8	10 8	10 8	11 14	11 4	11 4	12 14	20 0	20 0	27 0	75 0	75 0	78 0	10 8	10 4	10 4	10 0	9 12	9 12	
Rajputana.	Jeypore ...	19 0	18 8	17 0	6 0	6 0	6 0	9 0	9 8	8 0	27 0	28 0	23 0	...	...	...	16 0	14 12	15 8	14 8	14 8	15 4	
	Meywar (Oodeypore) ...	24 3½	22 4½	17 3	10 2½	10 2½	10 2½	...	...	...	27 5½	27 7½	20 5	200 0	200 0	200 0	12 1¼	12 1¼	11 11½	11 11½	11 11½	11 5¼	
	Indore ...	22 0	22 0	20 13	9 0	9 0	10 9	10 0	10 0	13 4	28 0	26 0	23 0	105 0	105 0	100 0	12 8	12 8	11 3	12 0	12 0	10 11	
N.W.P.	Farukhabad ...	23 4	22 0	21 8½	5 8	5 8	7 5	17 3	17 0½	12 10	27 8½	25 9	26 8	130 0	130 0	145 0	12 15	12 10	12 8	12 8	12 8	11 14	
	Cawnpore ...	23 8	23 0	22 8	9 0	9 0	9 0	16 0	16 0	12 8	30 8	29 8	29 0	150 0	150 0	150 0	15 0	15 0	13 8	14 0	14 0	13 0	
	Allahabad ...	22 4	22 0	19 8	8 0	8 0	9 0	15 4	15 4	14 4	30 0	30 0	29 4	150 0	150 0	120 0	12 0	12 8	12 0	12 0	12 0	11 0	
Oudh.	Lucknow ...	22 12	23 0	21 12	6 0	6 0	6 0	16 0	16 0	12 12	26 0	25 12½	26 3	110 0	110 0	115 0	11 8	11 8	11 8	11 0	11 0	11 0	

PRICES CURRENT OF FOOD-GRAINS THROUGHOUT INDIA FOR THE 1st HALF OF APRIL 1885.

QUANTITIES PER RUPEE IN SEERS OF 80 TOLAHS.

Provinces	Districts	Wheat: Present fortnight	Wheat: Past fortnight	Wheat: Corresponding fortnight of 1884	Rice (best sort): Present fortnight	Rice (best sort): Past fortnight	Rice (best sort): Corresponding fortnight of 1884	Rice (common): Present fortnight	Rice (common): Past fortnight	Rice (common): Corresponding fortnight of 1884	Gram: Present fortnight	Gram: Past fortnight	Gram: Corresponding fortnight of 1884	Firewood: Present fortnight	Firewood: Past fortnight	Firewood: Corresponding fortnight of 1884	Salt: Wholesale prices per maund of 40 seers: Present fortnight	Salt: Wholesale: Past fortnight	Salt: Wholesale: Corresponding fortnight of 84	Salt: Retail: Present fortnight	Salt: Retail: Past fortnight	Salt: Retail: Corresponding fortnight of 84	Remarks
		S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	S. Ch.	R. A. P.	R. A. P.	R. A. P.	S. Ch.	S. Ch.	S. Ch.	
Bengal.	Calcutta ...	16 0	15 0	15 0	8 4	8 4	7 8	11 6	11 6	13 0	19 0	19 0	18 10	90 0	110 0	90 0	2 12 0	2 12 0	2 12 0	13 4	13 4	13 0	
	Dacca ...	21 0	16 0	16 4	16 0	16 0	13 0	17 12	17 0	14 0	16 0	17 4	17 4	80 0	80 0	90 0	3 0 0	3 0 0	3 2 0	13 2q	13 2	12 8	
	Patna ...	21 0	21 0	22 8	10 8	10 8	11 0	21 0	21 0	14 0	24 0	24 0	24 8	100 0	100 0	100 0	3 0 0	3 0 0	2 14 8	12 0	12 0	10 8	
	Cuttack ...	21 0	21 0	19 11	13 2	13 2	13 2	17 1*	19 11	19 11	19 11	21 0	24 15	80 0	80 0	80 0	2 12 0	2 12 0	2 12 0	14 0	14 0	14 0	* The retail price of co[…] rice in the interior varies f[…] to 26-4 seers per rupee.
	Hazáribágh ...	15 0	14 8	14 0	10 0	10 0	10 0	14 8	15 0	14 0	17 0	16 4	16 0	320 0	320 0	320 0	3 10 0	3 12 6	3 8 9	10 0z	10 0	10 0	
Assam.	Sylhet ...	10 0	12 8	13 4	12 0	11 4	10 8	9 0	18 8	15 0	...	...	13 4	108 0	108 0	108 0	...	...	3 4 0	12 8	11 4	12 8	
																	S. Ch.	S. Ch.	S. Ch.				
Bombay.	Bombay ...	...	...	...	...	...	...	...	...	...	19 12	18 2	16 3	68 4	58 3	58 3	14 5	12 9	14 6	12 9	12 9	12 9	q. In the subdivisions t[he re]tail prices of Salt per Rupee w[ere] Manickgunj 12 seers, Mo[…]gunj 12 seers 12 chittack[s], Narsingunj 14-3 seers.
	Poona ...	...	...	...	...	...	...	...	...	...	18 6	18 6	18 6	68 0	68 0	68 0	14 11	14 11	14 11	14 7	14 7	14 7	
	Karachi ...	...	...	...	...	...	...	...	...	...	17 0	18 0	19 0	85 0	85 0	90 0	16 13	18 8	17 11	16 0	17 0	17 0	
Madras.	Vizagapatam ...	...	...	...	...	...	...	...	...	...	27 8	29 3	44 8	93 5	93 5	93 5	15 3	15 3	14 10	14 0	14 0	14 0	z. 10. The retail price o[f …] at Chatra was 10 seers.
	Madras ...	...	...	...	...	...	...	...	...	...	20 2	19 5	26 8	82 10	82 10	83 13	16 14	16 14	16 14	16 8	16 8	16 8	
	Trichinopoly ...	...	...	...	...	...	...	...	...	...	23 2	23 2	33 14	97 8	97 3	97 3	17 0	17 0	17 13	16 3	16 3	17 0	
Punjab.	Delhi ...	22 0	22 0	19 0	...	...	...	14 0	14 0	12 0	30 0	29 0	25 0	90 0	80 0	80 0	13 0	13 0	13 0	12 0	12 0	12 0	
	Lahore ...	No return received			...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Peshâwár ...	26 0	26 0	26 0	...	...	...	13 0	13 0	12 0	26 0	30 0	33 0	98 0	98 0	124 0	45 8	45 8	41 10	44 0	44 0	40 10	
C. P.	Jubbulpore ...	20 0	23 0	24 0	13 0	14 0	10 0	15 0	17 0	13 0	29 0	30 0	28 0	120 0	120 0	120 0	11 8	11 12	11 6	11 0	11 4	11 4	
	Sambalpur ...	29 12	26 4	24 8	22 12	28 0	26 4	29 12	29 12	28 0	19 8	19 8	19 8	125 0	125 0	125 0	11 13	11 0	11 0	10 14	10 0	10 0	
B. Burma.	Akyab ...	...	...	...	12 0	12 0	12 0	17 0	17 0	15 0	10 0	10 0	9 0	264 0	264 0	240 0	35 0	35 0	35 0	32 0	32 0	30 0	
	Rangoon Town ...	20 9	20 10	15 5	16 10	16 8	11 2	18 6	17 10	12 9	18 9	18 9	21 2	320 0	320 0	320 0	50 10	50 10	50 11	29 4	29 3	22 10	
	Moulmein Town &c. ...	9 0	9 0	9 0	11 8	11 8	10 8	13 8	13 8	13 8	13 8	13 8	13 8	220 0	220 0	220 0	30 15	30 15	30 8	30 8	30 8	20 15	
	Secunderabad ...	16 12	16 5	15 5	7 14	7 14	7 14	12 3	12 3	9 13	16 5	16 5	16 5	125 0	125 0	125 0	10 11	10 11	10 14	10 3	10 3	10 6	
	Mysore ...	10 0	10 0	12 8	10 8	10 0	11 14	11 4	11 0	12 14	20 0	20 0	27 0	75 0	75 0	78 0	10 4	10 8	10 8	9 12	10 0	10 4	
Rajputana.	Jeypore ...	18 8	18 0	16 0	6 0	6 0	6 0	9 8	9 0	8 0	28 0	26 0	23 0	...	...	...	14 12	14 12	15 12	14 8	14 8	15 8	
	Meywar (Oodeypore) ...	22 4½	25 0	15 10	10 2½	9 12½	10 2½	...	...	...	27 7½	24 3½	21 14	200 0	200 0	200 0	12 1½	12 1½	12 1½	11 11½	11 11½	11 1½	
	Indore ...	22 0	24 0	16 3	9 0	9 0	9 3	10 0	10 0	10 0	26 0	27 0	24 10	105 0	105 0	100 0	12 8	12 8	12 0	12 0	12 0	11 6	
N. W. P.	Farukhabad ...	No return received			...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	Cawnpore ...																						
	Allahabad ...																						
Oudh.	Lucknow ...	No return received			...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

THE

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A

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THE condition of the people in the distressed districts of Beerbhoom, Burdwan, Bankura, and Murshidabad appears to be at the best bordering upon famine. Nor is this the only affliction with which they have to contend, for in several villages of the districts mentioned above, cholera has made its appearance and is causing serious havoc, the condition of the under and ill-fed people being only too favourable to the spread of the disease. To complete the role of suffering there has been a severe scarcity of drinking water. Normally there is an insufficient supply of water in these districts, and that owing to natural causes,—the silting up of rivers and tanks being the most prominent among them,—it is growing less and less. The tract in question has somewhat doleful famine history. In the great Bengal famine of 1769-70, it lost three-eighth of its population. The above districts have suffered more or less from every famine that has visited Bengal ever since.

A CERTAIN section of the vernacular press of Calcutta and the Indian Association were the first to call the attention of the local Government to the serious out-look in these districts, for which they have been systematically run down by a section of the Anglo-Indian press who are most ill-informed on the subject. The reports which the vernacular press has been publishing from time to time of the distressed tract have, generally speaking, never been contradicted. If the Government with its full complement of Commissioners, Magistrates, Deputy Magistrates down to chaprasis, finds it difficult to collect accurate information, inorder to contradict these reports item by item in a district lying under its very nose, the irresponsible charge of exaggeration on the vernacular press may be taken for what it is worth. It need also be distinctly borne in mind, that in these questions the faults of commission are more excusable than those of omission.

THERE is nothing of which it can be more truly said that early measures are always the best measures. The Bengal Government has at last seen its way of estimating at their proper value the latest efforts of the Indian Association, the native press and the charitable public to alleviate the sufferings of the people. All these, however, are but a drop in the Ocean; Government relief measures on a much larger scale and on a more liberal principle should forthwith be opened before famine is sore in the land. It is already knocking at the door. If the local authorities instead of trying to muzzle the vernacular press and discredit it in the eyes of the Government, work in harmony with it, much good may be done out of the agents of relief already at work in the distressed tract.

IT seems that in certain maujas in the North Lakhimpur Sub-Division, Assam, the people are suffering from scarcity. Some 4,000 persons are all but destitute, and the Assistant Commissioner has been engaged in doling out money and rice to them for several weeks past. The Government will no doubt continue to relieve the extreme wants of the people, but in such a case there is always a good deal of suffering which Government fails to fully realize in time.

It is estimated by Mr. Smeaton, Director of Agriculture, N. W. Provinces, that the United Kingdom this year in addition to her own home-grown crop of wheat amounting to nearly 82½ millions of bushels, will require 140 millions of bushels, or 3⅞ millions of tons from other sources. In America the total crop of 1884 amounted to 512⅞ millions of bushels. The stock in America in March amounted to 169 millions of bushels, or over 4½ millions of tons. The prospects of the American winter wheat crop are unfavourably reported on, and it seems, therefore, not improbable that over and above the quantity she requires for home consumption during the remainder of this year, America may hold up large reserves of grain in view of a future shrinkage of stocks. In that case her exports to England are likely to be limited; and if this be so, 410,000 tons of North-Western Provinces and Oudh-wheat available for export are not unlikely to command a fair market in Europe. "If a conjecture can be hazarded," says Mr. Smeaton, "I should say the trade in North-Western Provinces and Oudh-wheat will improve as the season goes on; unless, of course, the American prospects brighten up, or any scarcity in India raises the prices of all food crops, and thereby closes the door to exports beyond the sea."

*

The Madras Industrial School appears to be doing good work. During last year, 20 boys passed out of the institution, 11 of whom obtained employment in the gun carriage factory, in the railways, and in private establishments. Since the end of the year two boys have been sent to Quetta, another has obtained employment on the Madras Railway, and a fourth has gone into business at Bangalor

* * *

The 53 boys on the roll of the school are distributed as follows:—Learning book-binding 11, learning carpentry 11, learning shoe-making 10, learning blacksmithery 10, learning rattan work 11. During the year all the boys belonging to the school were (in accordance with the suggestion of the Director of Public Instruction) examined in the various handicrafts at different Public Workshops: 23 lads at the Perambore Works, Madras Railway Company, 11 in shoe-making and 12 in rattan work. The Acting Loco-motive Superintendent's report on the work turned out by the lads is very encouraging. 10 lads were also examined at the Lawrence Asylum Press, Mount Road, in book-binding. The Deputy Superintendent of the Press reports that the lads "will become proficient binders in due time." 8 boys were examined in smithery, and 9 in carpentry, at the Public Workshops. The General Superintendent's report shows that the lads did very creditably.

* * *

Silk-weaving seems to have been practised at Tanna in the Presidency of Bombay for some 2,300 years. In the sixteenth century as many as 4,000 weavers were employed, but there are now only seven families of weavers left, who do not turn out more than Rs. 5,000 worth of silk annually. They are Catholic Christians supposed to be of Mussulman origin. The silk woven in Tanna, all purchased in Bombay, is of four kinds, superior Chinese, inferior Chinese, Russorah and Persian. It is not usually purchased till it is wanted, and for that reason orders have generally to be given beforehand. Nine chief dye-stuffs are employed, carbonate of soda, country soap, alum, copperas, pistachio galls, isparuk, myrobolam, rottleria and cochineal. The result is very effective, and the silks have a great deal of "wear" in them. In 1580 Tanna was the seat of a great velvet manufacture, but that art has been entirely lost.

* * *

Mr. Mylne, of the firm of Messrs. Mylne and Thompson, of Beehea, recently visited British Burma with the object of introducing the Beehea sugarcane mill into the province. The experiments conducted by him with a Beehea double-squeeze mill were generally satisfactory, as far as they went. But it appears that, owing to the large size of the cane grown and the draught power of the cattle, which is great, something more than the mill experimented with is required for Burma. The difficulty, it is thought, will be solved by the construction of a double-squeeze mill, with a large break-roller, and Mr. Mylne is going to have such a mill made in England and sent out to Burma. The several methods of boiling cane juice adopted in South Behar were also shown to the Burmese cultivators, and the methods were admitted by them to be superior to their own. Mr. Mylne, we hear, intends sending a small party of Indian agriculturists to Burma to try the cultivation of various Indian crops on a limited scale. The men will be selected from Shahabad. Sugarcane, peas, wheat, Indian corn, and gram are among the crops with which it is proposed to experiment.

* * *

It has been resolved by the Government of India to prescribe the adoption of the scale of colors, recommended by the Statistical conference, for the illustration of percentages in maps prepared for the representation of agricultural statistics. The scale is a simple ascending one, and will be generally employed in showing percentages above zero of rainfall, crops, irrigation and the like

over different areas. The amount of difference in percentage to be indicated by the different colors in the scale will be left to the discretion of Local Governments and Administrations. The maps will be colored by hand, and to facilitate this, the Stationery Department will be asked to supply, or indent, to Local Governments and Administrations, small boxes containing colors in cakes corresponding exactly with the prescribed scale. It will probably be found convenient that as soon as a given scale of percentages is adopted, the percentage which each color is to express should be clearly shown on a label fixed to the outside of every box.

* * *

MR. WILSON, C. E., the Engineer hitherto attached to the North-West Province Agricultural Department, for experiments in reclaiming land sterilised by *reh*, in trial wells, and other miscellaneous jobs—employed his furlough in looking up the agricultural implements of America, with the object of ascertaining whether there was any which might be adapted for successful use in India. The origin, of course, of so much inventive talent being directed to agricultural machinery and implements in America, is the scarcity of manual labour, and the high rate of wages. In California, where Mr. Wilson spent most of his time, the European labourers get 2½ dollars a day. In the Southern States, where negro labour is employed, the conditions more nearly correspond with those in India, where labour is comparatively cheap. The difficulty of obtaining labour led to the invention of the Sulkygang plough, worked by one man sitting upon a very uncomfortable, high seat, with eight or ten horses, and turning a furrow of three feet wide and seven or eight inches deep. The Watt plough which is largely used in the Southern States has been already adopted by the Cawnpur Farm, and formed the basis of the design of the *Kaisar* plough. The *Kaisars* originally issued were on the swing-beam system; and were objected to by native agriculturists, accustomed to the long beam. The same objection was made in Mexico on the first introduction of swing-beam ploughs, and the people would not have them till fitted with poles. They now use nothing but swing-beam ploughs. So there is hope that the Indian agriculturist may come round to this view, and not stake his whole success on the possibility of twisting his bullocks tails. Mowing and reaping machines are not likely to come into general use in India; being most useful where labour is not available at special agricultural seasons. Of sugar-cane machinery, the Cook evaporator has already been procured by the Agricultural Department, and modified to suit the special requirement of the country. It attracted much notice at the various agricultural shows in the North-West Provinces where it was exhibited, and promises to become popular in time. Windmills, of which Mr. Wilson's pamphlet gives several illustrations, are not likely to find favour in India. They have been tried over and over again, but have either failed to turn out the required work, or have been carried away bodily during some one of the many dust-storms of the Indian summer. The Turbine windmill may perhaps have a better chance, as its maker says it will work in the strongest wind, and Mr. Wilson himself saw one in the Government Farm at Tokio, Japan, where it had worked for two years with very little repair, and had stood the force of the typhoons without damage.

* * *

THE Government of Madras have sanctioned the proposal to postpone the abolition of the Government Farm at Saidapet till September next. With the close of the farm, direct Agricultural experiments on the part of Government will, for a time at any rate, be at an end. But Mr. Wilson suggested in a letter addressed to the Secretary to the Government, that arrangement should be entered into with some substantial cultivator for the cultivation, on a block of land say of 50 to 100 acres in extent in one of the delta tracts which ordinarily is cultivated with rice only, of a diversity of crops, one only of which shall be rice and the others crops that are not usually classed as irrigated, the cultivator being guaranteed against loss by a covenant on the part of Government to make good to him the loss, if any, incurred by him in making the experiment. The question of loss or no loss would be determined by the relative value of the products other than rice with that of rice grown on the same area; this again being determined by reference to the value of the produce raised on the rice-cultivated area of the block or by consideration of what, in ordinary years, the same land can be shown to have produced when cultivated with rice. For an experiment of this kind, Mr. Kristnasawmi Mudaliar of Shiyali would, if he can be induced to undertake it, be admirably fitted, and the sanction of Government to enter into a negotiation with him on the matter was asked. There is another point of view from which the introduction of a diversified agriculture in irrigated tracts of wide area is desirable. The losses sustained every year by cultivators in the attacks of insects, from fungoid diseases and from closed ear-shoots (kodu) and deaf-ears may not, impossibly, be due, in a great measure to the exclusive cultivation, for a long period of years, of a single product, and the introduction of new and varied products might not impossibly have a considerable effect in mitigating, if not removing

the evils from which the single product at present suffers so seriously. The experiment in tobacco-curing should be made in the Godavari, and for this purpose, the services of a trained and professional curer should be obtained for a time. The tobacco of this country, is generally admitted to be good in quality, but it fails commercially because of defective curing. It should be shade-dried and cured under professional supervision, the leaf being treated from the time it is cut by the ryot, entirely by the curer. The services of a professional man might probably be obtained from the Poosa (Bengal) works of Messrs. Beg, Dunlop and Company, and and if Government approve of the proposal, negotiations should be entered into for getting a competent man. Should this experiment be successful, the enterprise will, probably, be followed up by private capital which, at present, is too timid to venture on a business, the success of which may seem to it problematical. The experiment might be taken advantage of to introduce and maintain a higher class of tobacco, and would not improbably lead to a higher standard of cultivation and treatment of the plant by the cultivators."

* * *

GOVERNMENT have approved the above proposals and authorized the Director to enter into negotiations for the purpose indicated. When in a position to do so, the Director will submit, through the Board of Revenue, an estimate of the approximate charge for which Government may be possibly liable in connection with the first experiment and of the cost of the experiment in curing tobacco.

* * *

THE special correspondant of the *Bombay Gazette* sends an account of the opening of the great International Exhibition at Antwerp by the King of the Belgians. Speaking of the inspection, made by the Royal Family, of the Indian Section, Bombay Department, he writes :—

This Department—for which General Waddington is the Commissioner, and a very hardworking one, too—is shown by Mr. Pestonjee, whom most of my Bombay and Madras readers will be sure to know. The contents are as numerous as they are handsome, and drew forth continued exclamations of surprise and admiration from the King and all the Royal Family. His Majesty requested General Waddington to present Mr. Postonjee to him. This the General at once did, when the King entered into conversation with the plucky Indian exhibitor, asking for explanations of this, that, and the other; showing great interest in the handsome goods laid out very tastefully before him. Her Majesty the Queen too, entered into conversation ; and when the King had quite finished his tour of inspection in this charming section, he bade Mr. Pestonjee good day, and promised " that he would come again next month, expressly to see this section again." "It is *tres charmant, magnifique,*" added the King on leaving. The small figures representing nautch-girls, ayahs sepoys, ghosais, dhobies, and drummers ; the toy elephants ; the Bombay carved ebony desks and work-boxes ; the sandal-wood card-cases, handkerchief boxes. work-baskets ; the boxes mounted in ivory, but made of buffalo horn ; the *lotas* ; all the Vizagapatam ware ; the models of the " Trichy" rocks and fort, and the Seringham Temple ; the handsome and elegantly worked brass-ware, such as the magnificent vases cups, and plates ; the plated silver Benares work ; the Moradabad work ; the Tajmahal and Jooma Musjid models : the Tanjore work—copper vases mounted in silver ; the copper and brass exhibits, such as jugs, *cudoms, lotas, suraies*—all and each of these handsome articles were much admired by King Leopold and the Court of Flanders. The Queen paid particular attention to the Sialkote vases and the Bombay art pottery—the pretty blue-and green goblets, the *lotas* in blue, green, and white, and the cups—all of the old Indian pattern.

* * *

A GOLD medal has been awarded by the Madras Government to Mr. Kristnasawmi Mudaliar for the improvements he has introduced into the agricultural implements used on his farm, and, by consequence, into the system of farming pursued in the district. In an account given by the official reporter of what he saw on the property in question, particular praise is given to the improved country ploughs now in course of being manufactured by the medallist. These are said to do more than twice the work effected by a common Indian plough, as it is enough to turn the paddy fields only twice with them instead of four or six times as was the practice with the old-fashioned machines. They also require very little more labour on the part of the draught-animals, and are turned out at a price not much above that of the old ploughs. But the natives were very far from looking at the matter in this light. They manifest the same suspicion and dislike of innovations as most people in their condition, and it seems that on the first appearance of the new-fangled ploughs they made an attack upon them, and wrecked several. In the end, however, reason seems to have prevailed over prejudice, and the neighbours of the enterprising agriculturist have one by one begun to buy his ploughs, and set them to work on their own land.

* * *

THE American fish Commission are reported to have now over-come all their early difficulties in

connection with the experiments in sea-fish hatching, and they have built a large hatching station at a place called Wood's Hole on the Massachusett's coast. It is said that during the present season they will be able to send out millions of young fish to all parts of the new England coasts so as to re-stock the now deplenished waters.

*

MR. C. W. MCMINN writes to the *Pioneer* regarding the manufacture of charcoal iron :—Government and private Europeans have both made many experiments during the last century in the manufacture of charcoal iron. All these have ultimately failed from the exhaustion of the forest, carriage and manufacture of charcoal becoming so costly that the iron produced cannot compete with the imported article. Yet, strange to say, Sweden continues to cut down its forests and manufacture charcoal iron which can be sent to India and there sold at a profit. There is something wrong here surely. It appears to me that the fault lies not with the metallurgists who have devoted immense labour and technical skill to their work, but possibly with the foresters, who have not supplied cheap charcoal—possibly they have never been asked. So far as I can learn from the literature of the subject within my reach, the metallurgists have never been informed that the Indian hills are covered over, many thousands of square miles with a tree which grows nearly as rapidly as fir or pine, and which can be multiplied as rapidly as *bacillus* or *tænia*, as *kans* grass, locusts, or any other plague. I refer to *salai*, one of the Boswellias. Its charcoal manufactures the best iron, I am informed. It will grow in any soil but rather prefers rock ; nor like the bamboo is it curious in its likings for any special rock ; laterite and trap, gneiss or granite, Vindhyans or Gondwanas, it flourishes on all ; all alike are grateful to its vegetable maw and we see it consequently the most marked feature of the landscape throughout the Deccan. A young tree may be cut into twenty pieces, each of which if stuck in the ground, any ground, at any season almost, will faithfully take root and become in its turn a tree ; not a stunted sapling, but a tree, six or ten feet in circumference of trunk. It appears to me quite possible by scientific and systematic treatment of the *salai* to raise within a radius of five miles from each iron furance, quite enough fuel to keep it constantly supplied by proper rotation of cutting and planting. If so, the problem of charcoal iron in India will be solved. I would ask through your columns, that if I am wrong in any of the above facts, some one may correct me, as I would like to plant a few millions of *salai* trees next rains, through the zemindars in their forests and for their benefit. Brandis mentions this property of *salai* charcoal ; Drury, Ball, Balfour and others do not, so far as I can see. I cannot ascertain from the native workers there, whether *salai* charcoal alone will make good iron, or whether it requires admixture. There seems to be no doubt, I think, that, the English in India have acted like step-mothers to several handicrafts and industrial appliances—such as handlooms, wind-mills, water-mills, charchoal iron—because they are from birth partial to coal mines, and steam engines, and Arkwright looms.

* * *

MR. J. N. ATKINSON, Special Assistant Agent, Godavari, submitted to Government a report on an attempt made to introduce the culture of *tussar silk* into the Bhadrachalam taluk. From fifty to sixty cocoons which formed the breeding stock to begin with, he got about 15,200 cocoons of which roughly speaking 2,000 are in fair order. That the country is suited for sericulture is proved by the large quantity of wild *tussar* cocoons which may be found lying about the jungle. He is of opinion that if sericulture can be carried on at profit in Maugapet, he sees no reason why it should not be equally easy to do the same in the Bhadrachalam taluk. The Government have ordered that the amount of Rs. 92-14-2 expended by Mr. Atkinson be refunded to him. The attention of Agricultural Department has been specially directed to Mr. Atkinson's interesting report. The Department has, it is believed, had recently under consideration the possibility of establishing an industry in wild silk consequent on inquiries made by persons interested in the business. The Bhadrachalam jungles would, the Government observe, appear to be an excellent field for experiments.

*

WE gather from the report of Mr. C. Benson, M. R. A. C., Agricultural Reporter to the Government of Madras, the following facts regarding the Nagpur Government Farm. The farm is devoted to experimental crop raising and manuring – two most important branches of farming. Implements and Machines incidently receive attention. The series of manuring experiments started on the Farm promise to be most interesting. The size of the Farm is 95 acres. The Local Government has recognized the fact that to carry out valuable experiments, money must be liberally granted and ample time given to obtain results. The Central Provinces bamboo drill introduced in the farm is much clumsier than that used in the Ceded Districts. This has also been introduced in the Cawnpur Farm. Mr. Benson suggests that patterns of the Bellary drill should be sent to both Cawnpur and Nagpur for trial.

THE chief breeds of cattle in the Bombay Presidency are (1) Maisar, (2) Guzerati, and (3) Malvi. The first is of the Amrat Mahal type of Madras, and the second of the style of the Nellore breed. The silage made by Mr. Ozanne, Director of Agriculture, Bombay, was in appearance a decided success, and, after a little exposure and drying, smelt like well-made hay.

THE following is the Health Officer's memorandum on the vital statistics of the town of Calcutta for the month of May last :—The number of births registered in May was 598, against 676 in the preceding month. It exceeds all the corresponding totals of the past decade excepting 1875, and also surpasses the mean of the last 10 years by 89. The increase of 37 births over those of the corresponding month of the previous year is observable among all classes of the community, except Other Classes. There were 306 male and 292 female births in the month under record. The mean of the past decade was 509. There were 1,156 deaths registered in May, against 1,817 in the preceding month, giving an annual ratio of 32 against 50·3 per 1,000 of population. The proportion of male to female deaths was as 150 to 100. The total exceeds six corresponding figures of the past decade, and is also higher than the decennial mean by 135. The diminution of 13 deaths, as compared with those of the corresponding month of the previous year, is due to the marked reduction in cholera and fever, outbalancing the increase of deaths due to small-pox. With regard to the local distribution of diseases the following sections show the highest death-rates, *viz.*, Hastings 70·3, Taltola 50·6, Jorasanko 43·5, and Jora Bagan 40·3. The following sections show death-rates below the average, *viz.*, Park Street 4·8, and Waterloo Street 12·4. Infant mortality, reckoned on estimated births, was 297·2, against 331·5 in the preceding month per 1,000 of population per annum.

A COMPANY having for its object the ensuring to manufacturers of a regular supply of rhea grass is about to be established in Manchester. Large blocks of land specially suitable for the growth of this fibre are said to have been secured in Johore and Venezuela, and a supply of a thousand tons a month is confidently promised. The promoters assert that the material can now be laid down in England cheaper than either flax, cotton, or hemp, while it has qualities rendering it superior to either of them. Processes recently discovered have removed the old difficulties in spinning and dyeing, and rhea can now be adapted to almost any kind of textile fabric.

* * *

WE hear that the Madras Museum institution is to become limited in its operations. The present "Industrial" section is to be transferred to the School of Arts, which is considered a fitting place for such a collection ; the "Economic" section is to be given over to the Director of Revenue Settlement and Agriculture ; the Mineralogy and Geology will be placed under the Government Mineralogist, but continue to be located in the Museum premises ; while the work of the Museum itself will be confined only to Natural History and Archæology.

* * *

MR. W. J. DICKSON, Secretary of Legation at Teheran, reports to the Foreign Office that, while gloomy accounts reach him from the north of Persia, the information he receives from other quarters encourages the hope that our trade in the south has correspondingly improved since the establishment of direct steam communication between England and the Persian Gulf. "I may quote," he says, "the remarks made on this subject by the British Agent at Ispahan." He says that to a superficial observer (residing in the south) it may appear that the import trade of Persia has increased to a remarkable degree within the last ten years, seeing that greater quantities of loaf sugar and English piece-goods are brought into the country by way of Bushire. But in reality there has been but little change in the general amount of imports. It is the diversion of the channel from the north to south of Persia that has created upon the minds of those whose commercial ideas are confined to Bushire and Ispahan the impression that the trade of Persia has considerably increased. This diversion has been partly the result of a recent prohibition of the transit of foreign goods through Russian territory. Manchester goods were also formerly to a great extent imported through Turkey ; but importers have now taken advantage of the cheap freights and other facilities afforded them by the steamers which ply regularly with the Persian Gulf to bring their goods by way of Bushire, which has consequently become the chief port for the general import trade of Persia.

* *

THE following is from Mr. Blanford, Meteorologist to the Government of India :—Any condition that unduly raises the barometric pressure in North-Western India and on the Himalaya, in Afghanistan and Beluchistan, favours the north-west winds. And since rain on the plains and unusual snow on the hills keep the air cool and heavy, they afford such a condition. But if this

depends on the extent of the Himalayan snows alone, it is not very lasting, although it may operate for some weeks. At present it would appear that the influx of the monsoon rains on the west coast and in Southern and Western India generally is likely to be retarded, and it is this branch of the monsoon that brings the greater part of the rainfall to the Peninsula, Central and Western India. But in 1876, 1877, and the earlier part of 1878, the barometer was high over a large part of Asia, owing to some cause or causes as yet unknown ;and this undoubtedly was one cause of the severe droughts of those years. I have no means of knowing whether such is the case now, but there is no reason for assuming it to be so ; and therefore, as far as our information goes, there is no reason for anticipating more than a retardation of the rains of the west coast. If the conditions remain as at present there is no reason to anticipate any retardation of the monsoon on the Bengal side as well ; but the only ground at present for forming a judgment on this point is that there is a certain persistency in the weather phases of India ; and that as the north-west winds seem at present to hold down the west of the Peninsula rather than across Northern India, there is a balance of probability in favour of their remaining so.

SOME time ago a number of natives of Bombay interested in the promotion of Arts and Industries raised a fund amounting to several thousand rupees and selected Mr. Rajwade as the man best fitted to carry out their object of learning some useful handicraft in America. Mr. Rajwade left Bombay for America in June 1883. One Mr. Thomas Prag, the manager of the Manufacturing Gazette, interested himself out of pure philanthropy on behalf of Mr. Rajwade and induced Messrs. Moore Brothers of Cleyton, to keep him as an apprentice in their glass factory. Mr. Rajwade, by his peculiar aptitude for the work, was able to master the secrets of every branch of the industry in ten months only, though apprentice lads usually take four or five years to become good blowers. Messrs. Moore Brothers spoke of him as the only man of his age whom they knew to have succeeded in becoming a good blower. He returned to Bombay in October 1884 and, in a meeting held on June 14th last, showed a neatly executed wooden model of a glass factory prepared by him after his arrival here and explained the various stages through which the raw materials have to pass before they are converted into bottles and such other articles.

* * *

IT was stated that sand as good or even better than what could be had in America is to be found in India. The two most important ingredients required for making glass, namely, sand and lime were ready at hand. There was also prepared in this country rough glass in blocks, which were exported to foreign countries, and returned to India in the shape of glassware, increased some twenty times in value. It was stated that Mr. Rajwade could not start a glass factory in his own single person, and therefore it is proposed to bring out about half-a-dozen blowers from Europe or America, under a contract to work here for three years, and teach their art to the apprentices employed under them. The subscribers were informed that some gentlemen (foreigners) in this city were willing to enter into an undertaking to provide means for the acquirement of various useful arts and industries on favourable terms in countries much nearer than America.

THE following is from a correspondent of the *Englishman*:—The following grow with great luxuriance in Assam, particularly in the upper districts, where the soil is more prolific and the yield much greater :—

1. Sugar Cane.
2. Mustard seed.
3. Cotton.
4. Indigo.
5. Rice.
6. Wheat.
7. Oats.
8. Barley.
9. Jute.
10. Lac.
11. Opium (Govt. interdiction.)
12. Seeds of all descriptions.
13. Silk.
14. Tea.
15. Tobacco.

THESE are only a few of the many crops that can be raised from the soil of this fertile country. Many of the crops above enumerated, owing to the richness of the soil, can be obtained in the proportion of fifty to seventy five per cent. over the productive power of Bengal. When I refer to the export trade of British India within the last three or four years, I find that there is ample room for Assam to contribute her share towards the export commerce of the Empire. True, she contributes at the present time a little seeds and caoutchouc, but nothing else to speak of. There is an ample field for Assam in the production of unrefined sugar, which is exported to the extent of nearly five and-a-half millions of rupees annually. Surely we could contribute a portion of this ? Another item is wheat. Out of the eighty odd millions' worth exported, Assam could contribute a very fair quota.

* * *

WE learn from a local contemporary that a number of Hindu gentlemen is about to form a company at Madras to manufacture salt on

a large scale. Under the old system the ryots used to make the salt with advances received from the Government, and were obliged to sell all they made to the Government at fixed rate. Since the excise system, however, was introduced, the ryot can make as much salt as he is able, but the salt has to be deposited in the Government warehouse until the duty of two rupees per maund is paid upon it, when the ryot can sell it to whomsoever he pleases. The quantity of salt at present made in the Madras Presidency is altogether very large, although the quantity made by each individual ryot is comparatively small. But it is thought that by concentrating the business in the hands of the company, and purchasing the salt direct from the ryots, there will be a considerable increase in the quantity of salt made, and a handsome profit obtained by the company.

ENSILAGE.

THE question of ensilage is one of such importance to India that I venture to send you a few remarks on a number of papers that have been sent to various officials and others on the subject of silos and ensilage.

These papers are for the most part letters and reports on ensilage by men who have constructed silos in India, such as General Macpherson in Allahabad and General Wilkinson in Calcutta. Their practical experiences must be of great value to any one wishing to try similar experiments, but some of their reflections appear to be founded on insufficient data, and as I am a firm believer in the ultimate success of ensilage as a fodder preserver for certain parts of India, I think it right to caution intending experimenters against certain deductions which appear to me to require further evidence before they can be accepted as established facts. Excessive enthusiasm will discredit ensilage quite as much as ignorant prejudice. We must proceed with caution if ensilage is to become an institution in India. If the cultivator obtain results unequal to the expectations he has been led to form, he will view with distrust the new procedure, and may close his eyes to the real advantages which belong to this system of storing provender for use in times of scarcity.

Most of what I consider heresies on the subject are contained in the following 15 rules which were first published in the Englishman newspaper of the 7th February 1884. They were forwarded by the Secretary to the Executive Committee of the Calcutta International Exhibition to the Government of Bengal, which has circulated them together with other documents on ensilage. I do not know the author of these rules which may, it is stated, be taken as a safe guide, but as some of them are, I believe, misleading, I intend taking them seriatim.

1. "It has now been ascertained that freshly-cut green forage of all sorts, when still wet with rain or dew, can be preserved in silos for many months or years."

This is put too strongly. "Immature green food," according to the late Dr. Voelcker, one of the best authorities on the subject, "as a rule does not keep well when put into silos." This view is confirmed by the experience of General Macpherson in Allahabad. Some of the grass which he pitted quite young has putrified, and the stench arising from such silos has gone far to discredit in Allahabad the undoubted success obtained by the General in the case of more carefully made ensilage.

2. "Fodder thus preserved is found to contain about twice as much nourishment as the same amount of grass etc., made into hay, and to be more easily digested than green fodder."

I cannot conceive what can be the authority for this statement. None of the advocates for ensilage in England have, so far as I know, claimed this extraordinary merit for ensilage. If it were justified, farmers would at once give up making hay, instead of only resorting to ensilage when the weather causes the prospect of making decent hay impossible or at any rate excessively expensive. The loss of nutritive matter in well-made hay is very slight, while in the best silos one must expect a loss of at least 15 per cent. in the dry matter, while in *Katcha* silos, especially if the fodder be immature, the increased fermentation will raise the percentage to a much higher point. Nor is this all, I do not wish to be too technical, but there is good reason to believe that the nitrogen in ensilage deteriorates in quality. In one specimen tested by Professor Kinch at C'cester it was found that 55 per cent. of the Nitrogen in the ensilage was non-albumnoid, while in the grass of which it was made the percentage was only 9.

As regards the greater digestibility of ensilage I am prepared to admit that a small portion of the woody fibre is rendered more soluble by fermentation but ordinary grass is, I should say, quite as digestible when green as after it has been coverted into silage.

3. "To insure success in the preservation of green fodder, the air must be almost entirely excluded from the silo, and great pressure must be applied from above."

This note should, I think, run as follows. In packing a silo the air should be excluded as far as possible. The amount of pressure should vary with the nature of the fodder used. Tender grass is

very much liable to 'bleed' if the pressure applied be excessive, while old stalks of Indian corn will stand almost any amount of weight. The proper pressure is much disputed in England. Sir J. Lawes used only 80 lbs. to the square foot in a large silo calculated to hold 200 tons, which I saw him filling last august, while others contend that the right pressure should be at last 300 lbs. Further experiments are required before any general rule can be laid down.

4. "When opened after many months, the silage generally has a brown, mossy, and sometimes mouldy appearance, and a vinous or sometimes a sour smell. Horses and cattle eat it greedily, preferring it to any other forage."

This note being couched in general terms needs little comment, though the author might have added that in addition to the vinous and sour smell there is also not infrequently the smell described by captain Wengate as that between a brewery and a tan yard. It should also be remembered that though horses and cattle eat silage greedily, it does not therefore follow that it is more nutritious than other kinds of forage. Animals like human beings generally prefer tasty to more wholesome food.

5. "A silo may be made in the form of a trench or pit, wholly or partly under ground, or in the form of a building. The sides and ends of a silo must be smooth, and the upper portion of them (for about five feet) should be perpendicular. The lower part of them should slope slightly inwards to cause lateral pressure as the fodder subsides."

The latter portion of this rule which directs that the lower part of the silo should slope inwards is, I think, objectionable as the pressure is not so evenly distributed. The walls should be perpendicular from top to bottom.

6. "When the silos are constructed wholly above ground, and not inside barns or other buildings, it is desirable, if possible, to give them a northern rather than a southern exposure, and to avail oneself of any shade that is to be obtained. Hot weather prejudicially affects the silage, and it tells most on silos above ground."

As regards this rule I am sceptical. The heat inside a silo must, I think, depend more on the state of fermentation which ought not to be much affected by a hot sun, provided the walls are sufficiently thick.

7. "Walls should be smooth to facilitate settlement. When pits are dug in strong soils where there is no fear of flooding, the walls may nevertheless be smoothly plastered with advantage, or lined with planed boards set up on end, which is better than having the boards laid horizontally."

8. "When the fodder is cut, it should be got into the silo as soon as possible. The longer it is allowed to lie and wither in the field, the less likely it is to keep well."

Rules 7 and 8 are in my opinion unobjectionable, but it must be remembered that there are strong advocates, notably Mr. G. Fry, for slow loading and the manufacture of sweet silage.

9. "Crops for the silo are best cut when young and succulent. Cereals should be cut about the time when the head begins to be formed,—vetches, clovers, and grasses as soon as they come into flower."

Rule 9 may be accepted with the proviso that the crops should not be too young and succulent. It must also be remembered that for practical purposes when maize or other *Bhadai* crop is used, the ryot will prefer securing his grain and only pitting the reisdue though undoubtedly he will get a much inferior silage to what he would get if we could afford to cut his crop green.

10. "The stronger and more elastic the stems of the plants, the more weight will be requisite to compress them. When crops such as Indian corn, &c, are allowed to stand till the stems become old and woody, it may be preferable to pass them through a chaffing machine, as they would then pack well with less weight."

11. "It is not necessary with our ordinary fodder plants to mix straw or other dry material to absorb the moisture. Indeed such admixture would be likely to do more harm than good, so far as regards the preservation of the silage."

Rules 10 and 11 are, I think, unobjectionable. One of the reasons that straw should not be pitted with silage is, that the stems retain air which increases fermentation.

12. "If you have dry fodder that you wish to make more palatable to the stock, a small quantity might for the purpose be mixed with very succulent crops; but you must be careful not to add too much or you may endanger the condition of the whole. Few of our crops would admit of the addition of a tenth part of dry fodder."

Rule 12 is, I fear, wrong even with the limitations given. Mix your dry fodder with silage at the feeding time, so will you save space in your silo, and also benefit the stock which by the way should always be fed on dry food with silage as is done in France and never, if it can be avoided, on silage alone.

13. "Rain need not prevent the storage of crops in the silo. More damage is likely to arise from letting the crops lie long on the ground than from pitting them in a moist or even wet condition; but for all that an excessive quantity of water should be avoided."

Rule 13 is, I believe, correct.

14. "Salt is not required for the purpose of preserving the fodder, but a moderate quantity may be useful to the stock."

Salt invariably injures silage. The moderate quantity useful to stock can be added at feeding time.

15. "Weight amounting to 200 pounds to the square foot should be placed on the top of the silos."

The weight given is probably near enough to the mark considering our present knowledge of the subject, but, as said before, the proper weight depends on many circumstances.

Another letter to the Englishman dated 14th April 1884 contains a few golden rules that must be observed to secure success and as these give correct principles in a succinct form, I reproduce them.

1. The sides of silos must be as nearly perpendicular as possible.

2. The grass, etc., should be well spread and heavily trampled as it is being filled into the silo.

3. The weight on the top of the silo must be at least equal to 200 lbs. to the square foot, which is given by two feet of earth or bricks; and the more imperfect the silo, the more pressure it requires.

4. And, most important of all, the layer of the earth immediately over the top of the si[lo] must be made as air-tight as possible by simply working the surface of it into mud, and plastering this down. The primary layer need not be more than four or five inches thick. If earth is difficult to get, the remainder of the weight necessary may be made up with anything that is dry.

5. A silo may be filled with any number of different kinds of green forage, and this may be leisurely done in two or three days, but the quicker it is done the greener and fresher will be the silage. In opening a silo for use, remove as little of the weight as possible, as the pressure prevents the air from penetrating far into the mass."

I now turn to a letter of General Wilkinson's dated 29th April 1884. With much of what he says, I cordially agree, but I cannot admit that it has been proved to demonstration that cows usually yield *more* milk, and their milk *more* butter when fed on silage than when fed on green grass. Whenever there is fermentation, however slight, there must be loss of dry matter, and there is also a loss of nitrogen in an albuminoid form which has been referred to above. Therefore on scientific grounds silage cannot be so nutritious as the grass from which it was made, but it may be as well to examine the practical experiments on which General Wilkinson relies, as there are some who deride science when they imagine it is opposed to practice. The General experimented on six cows, feeding three on grass chiefly *ulu* for 1 month from 1st November 1884 and then on silage made from the same grass for 1½ or 2 months. He fed the other three cows for one month on silage and for the remainder of the time on grass. The amount of grass and silage given to each cow is not recorded. The kind of grass used was admittedly inferior, and the period selected for the experiment was not that in which the grass was at its best. The silage is said to have retarded the gradual decrease in yield of milk but it was "found impossible to tabulate the advantage gained by the use of silage for increasing the yield of milk." Under these circumstances it seems hardly worth while dwelling on the unsatisfactory nature of these experiments. I go on to examine the table showing the alleged improvement in the quality of milk resulting from the use of silage. In the first place, results obtained only by the use of a lactometer without also using a creamometer cannot be relied on.

Milk, as the General points out, is heavier while cream is lighter than water. From these facts it is obvious that skim-milk may, by a proper admixture of water, have its specific gravity so modified as to be exactly the same as a milk rich in cream. The General apparently decided that the deeper the lactometer sank before the cream was removed, the richer the milk. Now it is well known that feeding cows on very watery food such as brewers' grain will increase the yield, and at the same time deteriorate the quality, reducing the amount of solid matter in milk from over 13 to under 10 per cent. The higher the percentage of water the lower the specific gravity of milk, but so far as the lactometer shows, the quality is apparently improved. However granting that the amount of cream was increased, it is not stated how much of each kind of food was given. For a proper test the amount of silage should have been equivalent to the weight of grass from which it was made, and it should, if possible, be compared with green grass at its prime, and not with the dry stuff found in December and January. Sir John Lawes intended to carry out a series of experiments on the comparative value of silage and other foods on a number of cattle from the fodder he pitted last August. When those results are published we shall be in a better position to judge of the value of silage as a milk and fat producer. Let all who believe in silage as the great fodder preserver for India avoid hasty generalisations. More experiments are required before we can lay down definite rules.

I hope that these remarks will lead to further discussion on the points I have raised and that the errors I have made may be exposed as I have tried to expose those of others.

D. B. ALLEN C S. M.R.A.C. M.R A.S.

On Agricultural Duty, Bankipur.

THE REVIVAL OF INDIAN ART-MANUFACTURES.

SOME fifteen years ago, the class of men in the North-Western Provinces, engaged in making what is known as art-ware, was on the verge of absolute ruin. For, their costly manufactures were chiefly patronized by native princes and nobles, most of whom were swept away in the whirlwind of the great mutiny. Those admirers of art, who loved to gather around them the experts in each branch of industry, and who made Ahmadnagar, Delhi, Lucknow, Murshidabad and other capital towns, the centres of the most beautiful handicrafts, were no more, or had lost much of their former grandeur. Articles of the most exquisite workmanship could find no purchaser. The discerning eye and the skilful hand, which the artificers inherited from a long line of ancestors, either altogether lost practice or were compelled to undertake the unpleasant task of turning out cheap and necessarily inferior articles. Indeed, some of the best manufactures of upper India were at this time in their very last grasp of existence, while the state of others can be best realised by looking at the present condition of the Murshidabad Bidri and ivory work and the muslin-manufacture of Dacca. Fortunately upper India possessed splendid architectural remains of bygone times, its palaces, mausoleums and temples to arrest the attention of our busy rulers, to excite their curiosity, and to lead them gradually to admire those works of ingenuity, which, done in a small scale, formed the decorative household articles, while conducted on a high scale, developed into vast monuments of patient industry. An interest in Upper Indian art-manufactures was thus awakened among European officers of an æsthetic turn of mind, which saved many of them from utter ruin.

Unhappily, Bengal can boast of no past architectural history, for the skill of its people was, in the absence of materials of a more lasting character, wasted on bamboo, talc, feathers and straw, which the white ants have long since made them their food. The art-manufactures of Bengal have therefore succeeded to attract very little attention, and they have now been reduced to that pitiable condition from which the Northwest-industries have just been rescued. As bad luck would have it, the late exhibition, which put thousands of rupees into the pocket of the manufacturers of other Provinces, benefitted little the artisans of Bengal. This is owing to many native gentlemen having come forward with loan exhibits, which saved Government the necessity of purchasing them. Government is right in not incurring expenditure of public money where it could be avoided, and private gentlemen were also right in aiding Government to obtain good specimens free of cost, but nevertheless the bad luck of Bengal manufacturers must be deplored. The Murshidabad ivory-carving might be cited as an instance. This work, perhaps the best of its kind in all India, is now struggling for its very existence. But the manufacturers could not sell a single article at the late exhibition, as the specimens were all sent on loan by the Nawab Nazim, Maharani Swarnamayi, and others.

The evil days of the Bengal art-manufactures seem, however, to be now drawing to a close. A nucleus of an art-museum has been formed out of articles purchased by Government or presented by private gentlemen during the late exhibition. The expansion of this museum is now surely a question of time. As its principal object is to afford suitable encouragement to the art-industries of the country, the Bengal manufactures will doubtless first receive the much-needed help from its own Government, under whose direct auspices this useful institution is being organised. Such help, in order to be permanent in its effects, should take the form of devising the best means to secure purchasers of these goods. The plan adopted in 1876 by the Agricultural department of the N. W. Provinces proved highly successful in its results. This consisted in the establishment of an emporium of Indian art-ware at Messrs. Laurie and Staten's Hotel near the railway station at Allahabad, where European gentlemen going home halted before commencing their long railway journey to Bombay. As none but selected specimens of art were allowed to be kept in this depot, they soon found willing purchasers among these gentlemen, who took them to Europe as mementos of their Indian life or as presents for their friends at home. The profitable nature of the undertaking soon attracted the notice of private individuals which led to the establishment of similar shops in Bombay. Private enterprise has thus completed the work which Government commenced as a pioneering agent. Such a plan might be profitably followed in Bengal by encouraging some firm in the neighbourhood to keep duplicates of articles shown in the Art-museum. That visitors often fail or

experience great difficulty in procuring duplicates of this kind is beyond any doubt.

Of articles that found most favour among the purchasers at Messrs. Laurie and Staten's shop, the most important were the metal-ware of Lucknow, Moradabad, and Benares, and the wooden manufactures of Nagina, and gold jewellery of Lucknow, Delhi and Trichinopolly which severely tempted the purchasing propensities of lady travellers.

The Bidri-ware of Lucknow early attracted the attention of European admirers of Indian art. This work was invented many centuries ago by a Hindu King of Bidar, the ancient Bidarbha, the capital of king Nala, husband of Damayanti of Mahabharata fame. Bidri vessels are made of an alloy composed of copper, lead and tin, on which silver ornamentation, generally floral, is damascened. The Hindu king, who invented it, used the vessels to hold flowers which he daily offered to his household gods. Many improvements were introduced into the work by his successors, as well as by the Musalman sovereigns of the Bahmani dynasty in to whose hands Bidar fell on the subversion of the Hindu kingdom. The manufacture was introduced into Lucknow in the last century, where in the skilful hands of the workmen of Aryan India, it received fresh improvements. Lucknow also claims the invention of a new pattern called *Zarbuland,* in which the silver ornamentation is raised instead of being set even with the outside surface. In Bengal Bidri-ware is made at Purniah and Murshidabad, but the industry is declining for want of encouragement. Its introduction into Murshidabad is of recent date, being brought direct from Dacca by one Ilahi Bakhsh at the beginning of the present century. He employed under him a Hindu apprentice, named Lachhmi, whose son Munna Lal died about forty years ago, leaving the industry in a highly flourishing condition. But it has so declined of late years as to make its total extinction extremely probable, unless something is done to revive it.

The Moradabad and Benares metal-wares being cheaper than Bidri work have achieved vast expansion in this revival of Indian art-manufactures. Both are made of brass. In Moradabad the vessels are first moulded, turned and polished in the usual way. Floral or geometrical designs are then engraved upon them. The intervening space between the designs is coated with a preparation of lac which renders the surface of the vessel black; in beautiful contrast to the gold-like colour of the patterns on which the lac has not been applied. This work is known as the *siyah-kalamkari.* A few years ago, the sale of Moradabad ware hardly exceeded a few thousand rupees; now it gives employment to more than 1,500 persons, the value of whose annual production being estimated at three lacs of rupees. Benares ware is made of pure brass, and is sought after for the elegant shapes in which the vessels are moulded. Their colour of shining gold is also highly attractive. The little shops in the platforms of first class stations on the East Indian Railway bear witness to the progress which this industry has made of late years.

The black wood-work of Upper India is made at Nagina, a town of Bijnor District in Rohilkhand. It is in the hands of Muhammadan artisans and is said to have been brought from Multan two hundred years ago. The wood used is that of *kend* (Diospyros Melanoxylon), a tree abounding in the hilly forests of Mirzapur and west Bengal. The articles are embellished by patterns of flower and foliage carved in relief, the ornamentations being occasionally mounted in silver. The Mainpuri work is made of *Shisham* wood (Dalbergia latifolia) on which brass wire is very artistically inlaid. Only a few years ago this art was on the point of extinction, there being only one man left capable of executing good work. It owes its regeneration to Mr. Growse, C. I. E., now collector of Bulandshahr, and to the Agricultural Department of the N. W. Provinces. Eight men are at present engaged in this industry, a large quantity of whose handiwork is now exported to Europe.

T. N. Mukharji,

Revenue and Agricultural Department,

Government of India.

SUGAR REFINING

AT NASRIGANJ, BEHAR.

The *gur* which is bought in the form of *chaki* weighing about 20 to 25 seers each, is broken into pieces and mixed with water in a large iron pan in the proportion of 12 *nads* of water to 25 maunds *gur* (one *nad*=about 60 to 70 gallons).

This is slowly boiled and to the boiling liquid 5 seers of milk is added little by little. The scum that arises is removed by a large perforated shallow ladle termed *jhanjri.* The thin liquid thus obtained is filtered through a cambric filter placed over a bamboo basket made of sticks as thick as a finger, the baskets themselves being placed over *nads* of the same form as mentioned above. Out of 12 *nads* of water and 25 maunds of *gur*, 8 *nads* of the liquid is thus obtained.

Seven *saikas* or small *gharas* of the liquid obtained as above is taken to the pan and boiled. To the boiling liquid is gradually added a liquid preparation made of water and powdered castor-oil seeds from which the milky juice has been pressed out. On boiling for about 10 minutes the liquid becomes of proper consistency and is removed to a *nad* placed close to the pan. From this *nad* it is taken to the second and so on to the fourth, all placed in a row. By this time it cools a little and becomes thick.

By means of a *saika* the thick liquid is taken to another room and put in a *nad* which has underneath a hole stopped by grass rope. In one *nad* about 6 maunds of the thick liquid is put. It solidifies and a portion passes through the hole as *chhoa*. The solid mass of sugar is broken and strained so that all the *chhoa* may be removed. When all the *chhoa* is removed the sugar is found to be of light brown colour and granular. This operation of solidifying and removal of the *chhoa* takes about 12 days. Each *nad* contains about 6 maunds of the thick liquid and gives 3 maunds of *chhoa*. The brown sugar is removed to another room and put in a *nad* a portion of the bottom of which is made of grass mat. About 2 inches of *sewa* plant (Vallisnaria spiralis) is then put on the sugar. Every third day 2 inches of sugar is scratched away from the top as a pretty white granular sugar and a fresh lot of *sewa* is put on the remaining mass. This process is continued till all the brown sugar is converted into white sugar. This takes about a month. Out of 3 maunds of sugar in a *nad*, a little over ½ maund of *chhoa* and and a little less than 2½ maunds of white sugar is obtained.

The sugar thus obtained is exposed to the sun, trodden by feet, any bits of the plant and other foreign matter picked off, and finally packed for sale.

The scum of the first room and molasses of the 2nd and 3rd rooms are collected in a tank and at the end of the sugar refining season operated upon in the same way as *gur* and a kind of inferior sugar is obtained called *doma* or second crop.

Hundred maunds of *gur* yield about 40 maunds of sugar, and 6 maunds of *doma*, the quantity of molasses varying with the quantity of water used in the operation.

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On Agricultural Duty,
BURDWAN.

RAB CULTIVATION OF RICE.

IT is an aim of the "Indian Agricultural Gazette" to assist in the work of recording and publishing the record of the agricultural practice of India. The empirical rules by which this practice is guided are often as certain and fixed, as the principles laid down in Morton's Calendar or any other practical guide to the agriculturist. But the ryot can seldom describe his practice. The preparation of his land, the rotation he follows, the risks he avoids, the amount of seed he sows are all well known to him, but it requires much patience and ingenuity to worm out his knowledge. Still less seldom can the ryot give the reasons for his practice. Often he does not know a reason further than that he acts, as he has been taught to act by his father and by his own experience, and so it is that often charges of ignorance and want of foresight are made against him by those who have not recognized the difficulties of grasping the hidden principles which guide him, and who judge of his practice on his incomplete statement of his own case or on the hasty and incomplete statement of his case by superficial and biased observers.

I am far from asserting that the agricultural practices of this country are perfect and unimproveable but I maintain that improvement can not be expected till the practices of various tracts have been fully ascertained and recorded and studied by those, who have been trained or who have trained themselves to elucidate the principles underlying those practices.

The subject which I have chosen will illustrate my contention. Rab has been unconditionally condemned as a wasteful, ignorant and mischievous system of cultivation. I will quote from a Resolution of the Bombay Government on a Settlement Report as old as 1856.

"His Lordship in Council cannot but think that "the practice of manuring the rice lands with wood-"ashes which prevails in the Konkan,* and which "demands a most wasteful appropriation of large "tracts of hill-land for brush-wood, may have its "origin quite as much in the gratuitous terms on "which the fuel has hitherto been obtainable as in "the absolute necessity for supplying ashes to the "soil. No such system of manuring is found in other "rice producing districts of India, and it is possible "that its use in the Konkan is attributable to local "circumstances of revenue management rather than "to peculiarity of soil." It is candidly admitted in the very next paragraph that this statement

* Konkan—The country between the western ghats and the sea.

of the case against rab is founded on conjecture.

I would take the words quoted from the Settlement Resolution as the text of this paper, and will divide the remarks I have to make under the following heads.

(1) A description of the practice.

(2) Its geographical and climatic limits.

(3) Analogous practices in India and elsewhere.

(4) Its merits as ascertained from the considerations deducible from the above.

But I may at once state that I have formed the opinion that rab is based on sound principles, that it is more than a manure, that its origin is not, as conjectured by the Bombay Government of 1856, to be found in the revenue management of the Konkan, but the practice is attributable to local circumstances, yet not of revenue management nor of soil, but of climate.

The system as far as I know is peculiar to the Bombay Presidency, and will not, at first sight, atttract the attention of the readers of this Journal in other parts of India. Still it contains so much matter of intrinsic interest and is so good an example of the empirical knowledge of the ryot, that it will interest all who are interested in the aims of the Gazette. Rab is at the present moment a subject which is occupying the attention of the Bombay Government, and of landholders of the Konkan Districts. It has formed the subject of more than one anonymous pamphlet and of numerous articles in the local Press. I have commenced experiments in several places, designed to ascertain the comparative values of various kinds of rab and to investigate proposed substitutes for well established though alleged wasteful systems of rab. I propose to conclude this article with a description of those experiments and later on to publish the results and the deductions which I may feel it fair to draw from them.

The reason why rab is just now such a burning question is that it has run foul of the aims and objects of Forest Conservancy. From a purely forest point of view it is an unmixed evil. But if rab is necessary to the cultivation of the Konkan, and if a less harmful substitute cannot be found, it naturally follows that the evil must be acknowledged and met in a manner which will be just from an agricultural point of view, and at the same time with a minimum of impediment to the progress of conservancy. My claim is that I approach the subject without any bias, and I feel it my bounden duty to state fully the arguments on both sides.

What is Rab?

Rather than give my own definition first I would quote from the report of an Assistant Settlement officer penned in 1853 at a time when, with a sparse population, rab was practised at the wish of the people, without any limitation from either the Revenue or the Forest Department. The description is that of Lieutenant Henry Day, Assistant Superintendent of the Thana Revenue Survey, written before the introduction of the first Revenue Settlement by the Survey Department into the Konkan and in the infancy of the Forest Department.

" The next point," he says, "which claims our attention is the system of husbandry pursued in the " district, and I need hardly mention that this is " almost entirely connected with the rice cultivation. As soon nearly as the rice is off the ground, " the lopping of boughs from the trees, the collecting of underwood leaves, dried grass, cowdung " etc., for the purpose of burning a small portion " of land in which the rice plants are to be raised, " and afterwards planted out in the plots fitted " for their reception (the action of fire effecting " the destruction of weeds and noxious herbs and " at the same time very much increasing the productiveness of the land, operating thereto as a " manure) are manifestations—I might almost say " the only ones—of agricultural activity which are " apparent and these continue with almost unabated " diligence from the beginning of December to " nearly the end of May."

" To the several holders or rather holdings of rice " land there seem to be allotted portions of the jungle in their respective villages from which they " may collect fuel for this purpose, but sometimes " the entire able bodied population of a village " does not afford sufficient labour for this " arduous operation, in which case they appear " to help one another alternately, the helping " and helped villagers reciprocating these good " offices."

"The proportion of ground thus scorched or burnt is, of course, in proportion to the extent " of land to which it serves as a nursery as it " were; but this is generally about two or three " gunthas.*

" The art of arranging these combustible materials " consists, it appears, in spreading first the cowdung. " Upon it are strewed the boughs, grass etc. " Over all is spread a thin coating of earth. The " rice is sown in the ashes, (the products of this " burning) sometimes *before* the rain falls, and some" times and more generally *after* the first fall. In

* 40 gunthas = 1 acre.

"the former case it is termed the Dhulvaph * and has "this advantage that the seed springs before the "rain comes, and no time is lost thereby. But as "ploughing is needful in both cases to cover the seed, "this cannot be carried out where the soil is very "hard and deep. It is mostly limited to the neigh-"bourhood of the hills and shallow soils. It has a "further advantage, which I suspect has been felt "this year, that the rain sometimes comes down "with such little intermission, that a considerable "period may elapse before sowing and its attendant "ploughing can take place, while by the former "system, the young plant may have arrived at half "the maturity necessary for its transplanting be-"fore the seed in the latter system has been sown. "The land destined for the reception of young "plants is prepared thus :—

'Immediately after the first fall of rain it is "ploughed three times, the first ploughing being "called Ukhalni,† the second Dunani,‡ being at "right angles to the first, and the third Chikhaltas ‖ "so called I suppose from the state of the land "at the time of the third ploughing, which is usually "reduced to a state of mire from continued rain. To "break the clods yet more effectually buffaloes are "esteemed from their greater bulk, as better adapt-"ed for this latter ploughing than the ordinary "bullock. The Alwat Phali ¶ answering the purpos-"es of a roller though not a cylindrical implement, is "then drawn over the field, which is now levelled "and ready to receive the plant. I have omitted to "speak of the Dantale § or rake, which is used in "some cases, I believe, to cover the seed when "thrown into the ashes, instead of the plough, but "in all cases to smooth the surface after the opera-"tion (sowing) has been performed. It takes about "twenty days from the time of the seed striking to its "being fit for transplantation. I believe the plants "are all removed from the spot in which they were "sown. That portion is then ploughed up in its "turn and planted over, like the rest of the rice "plots—the rice grown upon it yielding a greater "amount of grain it is said, and the latter preferred "and kept for the next year's seed. I have never "had an opportunity of seeing these latter

* Dhulvaph (from dhul = dust, vaph = sowing):—the sowing (of rice etc,) in the dust just when the monsoon showers are expected, or just after the first shower and before the dust is perfectly laid. Molesworth and Candy's Dictionary.

† Ukhalni : literally—Scratching or Scraping

‡ Dunani : literally—Doubling, folding over.

‖ Chikhaltas : Chikhal—Mud, mire ; Tas—furrow.

¶ Alwat Phali : Plank harrow, a long heavy board drawn on its edges as a clod crusher.

§ Dantalo : Dant—A tooth. The implement is a light hand rake.

"operations, and describe them as related to me. "The plough used in this district is a very light "one and yoked by only two bullocks. From the "complete saturation of the earth during the rains "and the intense heat of the sun afterwards, it is "burnt almost to the condition of brick, and with "such ploughs until the rain has again softened the "earth, it could not be tilled. I believe that the "large Deccan plough with 8 or 10 bullocks could "work the soil during the dry season, but the plots "of rice are so small, that such teams could not turn "on them. The consequence is that all the plough-"ing for the year has to be carried on during the "first three weeks in June or during a shorter period "even, and ryots occupying more than five bighas * "require not only a corresponding increase of cattle, "but of ploughs also to enable them to get through "their labour in time."

This description is very accurate. It will be gathered that rab is a means of preparing the seed-bed for rice by burning on it layers of brush-wood, cowdung, grass, and leaves variously arranged. I will now reproduce an extract from a report which I wrote last year.

"Rabi is a method of preparing the seed-bed. "It is confined entirely to the seed-bed. The "greater the manurial value of the substances used, "the better the seedlings; and the better will be "the transplanted seedlings finally placed on the "seed-bed, not only for one, but for two or perhaps "more years. But here the manurial aspect of "rab ends. There are other and more impor-"tant objects. It is essential that the seed-bed "should receive the seed as soon as possible after the "fall of rain. [I had not encountered the Dhulvaph "practice when I wrote this.] In districts of very "heavy rain fall, to which the rab system of culti-"vation is confined, unless the rab has been good "enough to burn and destroy the seeds of weeds in "that area, the seedlings come with the weeds. The "seed-bed in these districts cannot be weeded, first "because it is half under water, and next because "the weeder would do much damage to and weaken "the seedlings if not altogether kill them. It is for "this reason that it is essential to prevent weeds "coming up with the seedlings. The seedlings have "the land to themselves and come up strong and "healthy. The significance of strong, healthy seedlings, "requires further comment. When they are such, two "or three are placed in each hole by the transplant-"er. If they are weak and sickly as many as twenty "may be required. With poor rab, therefore, a large "increase in the amount of seed sown in the seedbed "is necessary, in order that sufficiently numerous

* Bigha—about 30 Gunthas.

"seedlings may be obtained for transplantation." I stated in that report that the advantages of good rab are:

(1) That a larger area of land can be planted from seedlings raised in a given area.

(2) That the amount of seed therefore required to produce seedlings to fill a given area is less; and

(3) That the seedlings are ready for transplantation earlier.

I believe then that rab is a means of preventing weeds. It is confined to districts of heavy rain fall where the weeds are most numerous and most luxuriant. This is a characteristic which I had nowhere seen noticed in any report on rab till quite lately I read Mr. Day's letter. I lay stress on the fact that Mr. Day placed the destruction of weeds and noxious herbs as the first object of the practice though he rightly also noticed its manurial value. This is the right order and the appreciation of the fact of itself goes very far to prove that the conjecture of the Bombay Government in 1856 was founded on insufficient information and was erroneous.

Rab is not confined to rice cultivation. Two hillgrains *nachui* (or ragi) and *varai*, both varieties o Eleusine corocana, are almost exclusively raised in in the Konkan by rab.

I will not now touch on the various descriptions of rab but will only mention that in some tracts, where cowdung is used, it is used alone broken into irregular pieces about 1-2 inches thick and placed close together to cover the seed-bed. In other places a light layer of cow-dung is covered by layers of brush-wood, leaves and grass. In others the cow-dung layer is followed by layers of leaves and grass and earth. Brush-wood (loppings of tender branches, made when the leaves are at their maximum of growth and strength) is as far as I have seen always covered with layers of grass and earth. The earth layers in these varieties may always be replaced by a layer of pit-manure *viz.*, the collections of cowdung and village refuse made in the rainy season, when cowdung can not be dried. I may say that, in the established systems either cowdung or brush-wood forms the principal layer, and, so far as my information goes, it is only under the pressure of dire necessity that ryot attempts to make his rab without one or the other. When I describe the experiments now in progress, the various ingredients of rab will be specified.

[to be continued.]

E. C. Ozanne,

Director of Agriculture,

Bombay.

NEWS.

The latest news from the indigo districts in Bengal is more favourable, good rain having fallen throughout Krishnagar, Jessore, and Midnapur. The ultimate result of the season will now depend a great deal on an early or late inundation. The news from Murshedabad is not so favourable, as rain in that district has been only partial. Rain is badly wanted in most parts of Behar, though during the last few days the weather had become unsettled and rain was expected. No fresh news has been received from Benares or the North-West Provinces.

The export of wheat from New Zealand will be two and-a-half million bushels less than that of last year.

In the present large consumption of coal the question of providing another means for heating furnaces and engines has long been discussed. Among other means the extraction of gas from water has been thought of, but hitherto the experiments have not proved successful. Now however there is good reason to believe that the question of supplying and producing water-gas has been practically settled, and will soon come into operation.

Another attempt is about to be made to grow tea in Mauritius. An experiment was made a few years ago by a Mr. Jannet, which was not successful, owing to his knowing nothing about the cultivation of the teaplant. It was said that the experiment failed owing to the climate of Mauritius not being suitable for tea, but there are some parts of the island where both the climate and soil very closely resemble those of Ceylon, where tea is grown successfully.

From the account of the trade and navigation of British India for the month of April last, as compared with the correspoding month of last year, it appears that the total value of merchandise improted was Rs. 4,48,36,553 against Rs. 5,13,10,025, and that of merchadise exported Rs. 8,79,28,261 as against Rs 9,18,61, 933. The value of the treasure imported was Rs. 1,08,96,846 as against Rs. 1,61,06, 178, and that of treasure exported Rs. 2,27,059 as against Rs. 15,09,950. The gross amount of import duty collected, including the salt duty, was Rs. 13,87,372 as against Rs. 16,72 675, and of export duty, Rs. 9,37,517, as against Rs. 8,54,443.

It is the intention of the Government of India, we learn, to place the Forests shortly under the Revenue and Agricultural Department. They come at present under the Home Office, although it would be difficult to say for what reason. The change would be most welcome.

The quantity of new season's tea shipped from Canton up to the 7th May last was 784,548 lbs., as compared with 1,186,914 lbs. during the corresponding period of last year. The decline in the value of black tea exported from China during the year 1884 is estimated at 3,584,000 Taels, whilst the price of the tea per picul had fallen from 17·16 Taels in 1880 to 14 80 Taels in 1884.

The opium revenue for the current year starts favourably, so far, with an increase of Rs. 3,87,325 above the estimate, the actual receipts being Rs. 71,02,825 as against an estimate of Rs. 67,15,500

The improvement is entirely due to the Pass duty at Bombay, which exceeded the estimate by Rs. 5,22,275 whereas the result of the first sale of Bengal opium, from which the surplus is generally chiefly derived, was Rs. 1,34 950 below the estimate.

FROM the opening of the season up to the 14th of May 2,247 875 lbs of new season's tea had been shipped from Canton to London as compared with 2,275,862 lbs, shipped during the corresponding period of last year.

ON reconsideration of the subject, the Government of Madras is of opinion that it would be better to forego all duty on salt used for curing fish, having regard to the advantages to the public which will accrue therefrom. The present system of supply at cost price will be continued and it will be the object of the Department to suggest measures for extending the benefits of the system.

ONE of the first departments in Madras which is likely to feel the effects of the late orders for reduction of expenditure, will be the Forest Department. All temporary establishments are at once to be dispensed with, "cultural" experiments are to be stopped, and the purchase of stock is to be limited to the utmost.

THE Madras Government has decided that the proposals of the Director of Agriculture, for the formation of Civil Veterinary Department, shall be deferred for the present. In the meantime, however, it has directed an inquiry to be made as to whether Mr. Mill's course of veterinary lectures in the Agricultural College could not be delivered during one session, as under such an arrangement he could be enabled to carry out his inspections in the mufussal during the greater portion of the year.

THE latest news from the indigo districts is by no means favourable, and rain is now wanted almost everywhere. Although the October plant and the late spring sowings are holding out fairly well, both are beginning to show signs of want of moisture. In Behar the west winds have again set-in, and complaints are received from all quarters that the plant is suffering. The late re-sowings are not expected to come to much, and in some parts such as Southern Tirhut and Champaran they are so far gone that it is doubtful if a good rain would now be of much benefit. The only news from the North-West is that the area under cultivation is likely to be much less than that of last year.

THE possibility of protecting sheep and cattle against the severer forms of anthrax, by means of inoculation is now fully established in France, thanks to the efforts of Mr. Pasteur; and protection is said to be spreading more and more widely in that country every year. Mr Hallen, the Head of the Remount Department in India, visited the laboratory of M. Pasteur at Paris during his recent leave and also studied the question of inoculation at Edinburgh; and a report in which he speaks enthusiastically of the possibilities of protecting horses and sheep and cattle in this way, is now being circulated by the Supreme Government. Trial should be made, in the first instance, at Government farms and studs; and after experience of working in a hot climate has been gained in their case, the system should be widely extended throughout the country. Anthrax claims more victims than any other form of horse or cattle disease in India. There can be no doubt, therefore, that the introduction of successful inoculation for anthrax will prove an inestimable boon to the people, and there should be no reason why, if the system is extended sufficiently widely, this disease should not be gradually driven out altogether. In a matter of this kind, the Government of India is bound to use every effort, both to ascertain the real advantages which a system already accredited offers, and on being satisfied regarding them, to spread the life-giving knowledge until it comes within the reach of every villager. In the case of anthrax in England, it has been found that inoculation properly conducted will save 98 per cent. of the cattle of a flock, provided inoculation is made as soon as the disease makes its appearance in a flock.

MESSRS. J. THOMAS & Co.'s Price Current states :- There has been good rain over Bengal, and prospects have considerably improved since our last. In Behar the west winds still continue, and the plant is, in consequence of this, burning up, but heavy clouds are reported about, and we expect to hear of rain shortly. Mahai will not be general until about the first week in July. In the North-West rain is much wanted. Messrs. William Moran & Co. report:—We are glad to report good rain having fallen in Kishnaghur, Jessore and Midnapur, which has materially improved the prospects in these districts, and the ultimate result of the season, will now depend a great deal, on an early or late inundation. Rain has also fallen partially over Murshidabad, but the prospect in this district is not so good. From Behar our advices continue much the same, rain is still badly wanted, though reports received, within the last two or three days, speak of the weather being very unsettled. We have no reliable news from the Benares or North-West Provinces.

MAJOR J. CAMPBELL WALKER, Conservator of Forests, Southern Division, recently submitted proposals for the virtual abandonment of forest operations for the present in the Tanjore district. The Government order has, however stopped this retrograde step of abandoning everything. Only the proposed abandonment of the Casaurina plantations at Tranquebar, Kadambedi, and Negapatam is approved.

IT is well known that rice is sold throughout British Burma by the basket, but every market has its own basket, differing each from the other. This used to cause great inconvenience to grain dealers and merchants. Attempts had been made several times to fix upon a general standard but they were powerless to overcome trade customs and baskets of various sizes have continued to be used, notwithstanding the remonstrances of Chambers of Commerce and of Government officials. Once more, the question has cropped up and now it is proposed to invoke the aid of the Legislature on the subject.

IT is interesting to learn that India is the original home of the following fruits and vegetables : — Citron, Lemon, Mango, Cucumber, Kidney Bean, Rice, Cotton, and Black Pepper. The Mediterranean district is the original home of Poppy; China of sugarcane and sweet oranges : China, Assam and Manchuria of tea. Wheat probably comes from the

region of the Euphrates, Barley of Western Asia, Potatoe of Chili and Peru, and Central America of Pine-apple, Tobacco, and Arrowroot.

THE Government of Madras have passed order modifying and reducing the seniorage on timber and forest produce in the Madras Presidency.

THE Melbourne sales of Indian teas were large and fair prices were realized. Chinese were dearer.

THE Bengal Government have granted the sum of Rs. 10,000 for the immediate relief of the famine stricken people of Beerbhoom. In case when advances are taken for improving the supply of water, the interest chargeable on such advances will be reduced from three and one-eighth per cent. to one half during the next two months.

A book on "The Forests of the United States" compiled by Mr. Sargent, Profr. of Arboricuture in Harvard College, has been published by the American census office. The Professor recognizes as a fundamental principle of forestry that the produstion of timber is not only or even the first question to be considered. Forests perform important functions in protecting the surface of the ground and in regulating and maintaining the flow of rivers.

THE Bombay Government have made further concessions to the forest tribes in the Thana District. The privileges in regard to the collection of rab in protected and reserved forests are to be extended. A resolution of the 14th June allows the forest villagers to take free of charge, for their own use, leaves from teak trees growing in protected forests and from those of the reserved forests which are to be set apart for felling operations from year to year. The concession is made on the understanding that it will be withdrawn if it is found that on pretence of merely plucking the leaves, the branches are lopped and injury is done to the trees. A still greater concession is made in regard to karvi and thorns. The former will henceforth be removable from protected forests without the passes hitherto required; while passes will be required for the removal of thorns only from reserved forests. Lastly, villagers are to be allowed to take free of charge from protected forests earth and stones required for purely agricultural purposes. The result of these relaxations of the regulations hitherto in force is to reduce the weight of some, at least, of the grievances which the forest tribes have brought forward, though they by no means cover the whole ground of complaint.

THE Cocanada Agents of Messrs. Thomson Mylne of Beheea, have informed Government that they sold 217 of their portable sugar-mills in the two years 1882-83 and 1883-84, have already sold during the current year (1884 85) over a hundred, and expect to sell about 160. Their sales have been recently affected by the decline in the price of sugar and the consequent contraction of the sugar-cane area. The Government concur in the remark of the Board of Revenue, that considering the depression of the sugar market, this speaks volumes for the increasing popularity of the Beheea mill among the ryots of the Godavari district.

THE Auditor-General and Controller of Revenue, Ceylon, has at length arranged for the opening of the fish-curing yards in Ceylon after the plan adopted with so much success by the Madras Revenue Department. The experiment in Ceylon will be commenced in October.

ENGLISHMEN have been in the habit of laughing at the French for eating snails, but they appear to be taking to them very kindly themselves. The new delicacy has for sometime been obtainable at restaurants in London; it is now making its way into the provinces, and its price at Bristol is 2½d. a quart.

OWING to the prospects of the people having materially improved since the late rainfall, it is expected that relief operations in the Bellary and Anantapur districts will be stopped by the end of the current month.

Two experimental silos have lately been opened at Rawal Pindi. A quantity of churry had been closed up for several months. When opened, it was found to be quite fresh and was eagerly devoured by the bullocks who formed the testing committee.

THE experiment of Mr. J. C. Douglas, the naturalist, with imported Italian bees, has been crowned with complete success The bees seem to thrive perfectly in Calcutta, and have yielded during the season, up to date, eight pounds of splendid honey. The honey is taken straight from the centrifugal extractor, and without being strained or manipulated in any way, is pure, clear, fragrant and delightful to the taste. Mr. Douglas has shown how a lucrative industry might be established—an industry that would practically call a new dainty into existence.

THE normal area under wheat during the last few years in India is believed according to the latest estimates, to be about 26,000 000 acres, of which the average out-tur nis estimated roughly at 7,135,000 tons. The whole area cultivated in the year under review, which was exceptionally favourable for wheat, is estimated to have been approximately 27,620,223 acres, with a yield of about 7,613,096 tons. The increasing exports to the Mediterranean are worthy of notice, and understood to be due in a great measure to the suitability of Indian wheat for macaroni— A comparison between the prices of wheat in India and Europe tends to indicate that prices of wheat in India are influenced more by the general outturn of the Indian harvests than by the fluctuations of the price in the European market.

IT may be noticed also that the statistics before the Government of India tend to prove that the Agricultural population, so far from having, as is sometimes asserted, suffered from any diminution caused in the food-supply by the export of wheat, have, on the contrary, derived considerable benefit in the higher price which they have received for wheat, in the place of which they would to some extent have had to grow cheaper grains or non-edible crops. It has been proved in Oudh, for instance, that the ordinary amount of cheaper grains required by the people has still been kept in the Province, but that the value of the grain exports has been nearly doubled by the development of the wheat trade. In the North-Western Provinces it is reported that nearly a million acres have been brought under cultivation within the last five years, but the area under other food-crops has not only not diminished, but has actually increased. The reports

from the Central Provinces show a similar state of things. The Punjab, in which Province alone wheat is the staple food of the agricultural population, may also be said to owe its chief prosperity to the export of its surplus wheat.

An animated discussion is going on in the English papers regarding the utilization of insects as food for man. The following is one of the recipes recommended for adoption by insectivorous individuals:—"In certain parts of France, the *vers blanc* or cockchafer worm is freely eaten; in fact the following recipe is given for cooking the insects: Roll the *vers blanc*, which are short and fat, in a little flour and breadcrumbs, with a little salt pepper, and wrap them in a stout piece of paper, well-buttered inside; place it in the hot embers, and leave it to cook for twenty minutes, according to the degrees of heat. On opening the envelope a very appetising odour exhales, which disposes one favourably to taste the delicacy, which will be more appreciated than snails and will be declared one of the finest delicacies ever tasted."

A local contemporary says that since the attempt made three years ago to introduce Australian fish into this country has now finally failed, might not experiments be made with the Whitefish (*Coregonus Albus*)? It is good to eat, multiplies rapidly, and grows to a large size. Into England, the National Fish Culture Association have introduced Whitefish with great success. The spawn was incubated at South Kensington in March last year, and the fry subsequently transferred to ponds at Delaford, where they have thriven remarkably well ever since.

Referring to the Department of Morbihan, in France, Mr Vice Consul Jullian reports that "without exception the principal industry of the Department is that of the preservation of sardines and tuny fish in oil. On the coast of Morbihan alone, there are no less than 70 establishments, which give employment to 20,000 fishermen and more than 10,000 workmen consisting of tin-plate workers and women who prepare the fish. To this important industry several others are attached and supported solely by it; as for instance that of the manufactures of machine-made nets, and of tin-plates, the principal works for the manufacture of which give employment to over 800 workmen. These extensive establishments also possess workshops for printing and decorating tin-plates used for making sardine and other preserve boxes. The production of the sardine and tuny fisheries has been decreasing year by year for the past five years and in consequence the proprietors have suffered severe losses; so much so, that probably not more than 26 out of the 70 workshops will be in operation in 1885 owing to want o capital. Orders have been given by the French Government for an inquiry into this serious state of affairs, and an endeavour is being made to ascertain the causes which have led to an almost total disappearance of the fish from our coasts. Up to the present period, however, no definit solution has been arrived at.

One of the great objections of the Thibetans to bringing their produce into the Darjeeling district has attracted the attention of Government, and is likely to be removed. A block of 150 acres of camping and grazing land, in close proximity to the Kalimpong Bazar, has lately been set apart for the use of these traders, and it can be hoped that this concession, while it leads to an increase of our import trade, will also materially benefit the export of good manufactured in the district of which tea may be named as a not unimportant item

The Chief Engineer for Irrigation, Madras, gives a very useful, practical note founded on the experience of many years on the quantity of water required for irrigating an acre of land "The usual allowance of water in this presidency is," he says, "for large areas 2 cubic yards, per acre per hour." This allowance has been found to be sufficient on the average, but will not be enough when much of the land is being prepared for cultivation. As a rough guide, five months monsoon-rice crop requires 8,000 cubic yards, or two-one-sixth cubic yards per acre per hour. Three months after monsoon-ricecrop requires 6,500 cubic yards of water or about three cubic yards per acre per hour.

According to the Washington Agricultural Bureau the area planted with cotton in the United States this season is 18,000,000 acres. The outturn may be anything between six and eight million bales, the crop being of course dependent upon the favourable or unfavourable weather of the next three months. The last five years, in none of which was so large an area planted, give an average result of 6,650,000 bales.

The cattle have been attacked by anthrax in the Happy Valley, and numbers are dying. The rice-crops, too, are a month or so behind their time.

The Bengal Government estimates the stocks of rice in and around Calcutta, for the first week in June, at 2,265,383 maunds, of which twelve lakhs are available for export.

The hottest day in Calcutta during the month of May last was the 26th, when the thermometer rose to 103·7°, and the coolest was on the 7th, when it fell to 67·2°. The total rainfall of the month was 4·84 inches, the average for the last 48 years being 5·40 inches. Rain fell on ten days during the month, the average number of rainy days for the 24 years being thirteen.

The Madras Government, having arrived at the opinion that it would be better to forego all duty on salt used in curing fish, has ordered the present system of supply at cost price to be continued, and has requested the Salt Commissioner to report on the best means of extending the benefits of that system. This decision will probably lead to fish-curing becoming a very important industry in the Presidency. The quantity cured has already risen from 1,719 tons in 1881-82 to nearly 12 000 tons in 1883-84, and with cheap salt a considerable further increase may reasonably be expected, as the fisheries are capable of almost ind finite ex ension.

One of the London Daily Papers, the *Standard*, used upwards of 5,000 tons of paper last year in its daily issues alone.

The repairs to the embankments of the Red Hills tank at Madras have been so far completed that the Local Government has, on the recommendation of the Superintending Engineer, authorised the utilization of two million gallons for cultivation purposes during the present season.

We are glad to learn that the Saidapet experimental farm is not really going to be abolished as announced by us in our last issue. It would have been a suicidal policy to do so. The farm is only changing hands. The control is passing from the hands of the Board of Revenue to those of the Educational Department. The college will work it under the Department, will get the whole of the experimental farm buildings and all the implements and stock it needs, and will carry on nearly all the experiments that have so long been conducted there.

CORRESPONDENCE.

Mussoorie, 10th June 1885.

Dear Sir,

In your issue for May last, and on pages 26-27, you have placed before your readers some information on the subject of Mineral Manures, and as those containing *Phosphoric Acid*, are of great value to all Agriculturists, I enclose, for publication, a cutting from the "Mussoorie Hills Advertiser" of the 6th June on the subject of the local deposits of the Phosphate of Lime, or "*Phosphorite*" of the Geologist.

In addition to this, Phosphates of Lime, containing the remains of the Fish and Shells visible to the eye, are found in the Hill which divides Mussoorie from Landour, and as the same formation exists, at the same level, on the Landour Hill, Phosphate of Lime of the same description is sure to be found if sought for.

The Sewallicks contain this Fossil Phosphate with ossiferous remains, and Mr. Oldham of the Geological Survey of India, has spotted and mapped out the long lost locality, and there the matter rests.

If the Railway talked about is made to Dehra Doon, and is carried on and up to Mussoorie, an immense traffic in fossil Phosphate of Lime would be secured. But to find a Market, it will have to be sent to Landour. Phosphate of Lime, and its contained Phosphoric acid, are especially required by wheat-crops.

Yours faithfully,

F. Pogson.

Local Economic Geology.

The phosphate of lime first discovered last year at "Midlands" and other places in Mussoorie by the Rev. J. Parsons, and first analysed by Dr. H. Warth, has been subjected to repeated analysis in Calcutta and in various cities of Europe, with highly satisfactory results. The general conclusion regarding this phosphorite is that given in the last number of the *Geological Records* by Mr. Mallet, and fully endorsed by Mr. Medlicott, Superintendent of the Geological Survey, that "the substance is of high standard as material for the manufacture of artificial manure." The tricalcic phosphate amounts to about 76 per cent., in the nodular phosphorite and to about 66 per cent. in the non-nodular or stratified portion. See Records G. S. I. Vol. XVIII. Part 2, Page 126.

These phosphatic minerals require treatment with sulphuric acid, in order that they may be reduced to the form of super-phosphate of lime, or mineral manure. Reduced to this condition, the substance would supply just what is wanted in most of the Dun soils, for the improved cultivation of tea and cereal crops. Unfortunately the price of sulphuric acid, in this part of India, is too high at present for manufacturing manure on a large scale; and mere experiment is, in this case, unnecessary. If any ingenious and enterprising person will only put us in the way of manufacturing Hydric Sulphate *cheaply* and *plentifully*, our Dun soils may soon be rendered more productive by dressing them with the mineral phosphate which they need The phosphorite may be found wherever the chert banks and contorted shales immediately overlie the synclinal folds of the upper limestone.

EXTRACTS.

Application of Town Sewage to Agriculture.

With the increase of urban population and the introduction of additional water, came the urgency for the discharge of that water, and its accompanying refuse matters in compliance with the requirements of sanitary law. Pecuniary considerations had to give way, for the health of man was the primary consideration; and the application of that sewage to manure the land was a secondary, but still an important matter. A select committee of the House of Commons investigated the subject in 1862, and sewage irrigation was much discussed before and since that time in agricultural newspapers and other publications. Extreme opinions were expressed as to its agricultural value, for some said it was worth 20s. per head per annum, and fanciful notions were imbibed as to its produce on irrigated farms. Professor Anderson, in a lecture delivered under the auspices of the Highland and Agricultural Society of Scotland in 1864, estimated the refuse of each head of the population at 6s. per annum. Sir J. B. Lawes of Rothamsted states, that when the human excrements are deprived of water, they amount to about 46 lbs. per head per annum. But

when it is considered that about 80 tons of water is supplied annually to each urban resident, we realise in a great measure the enormous quantity of water with which the human excreta is charged. Dr. Voelcker, in treating on the value of sewage, states that there were about seven grains of ammonia in the gallon, which is the most valuable constituent, and the amount of the other manurial substances mostly phosporic acid and potash—rise and fall with it. It is hardly necessary to explain that sewage differs widely in character, according to the amount of water with which it is charged.

There are now said to be about one hundred towns which have dealt with their sewage, and those have been most successful who have sent it directly to land. Wasteful chemical processes, settling and precipitating tanks, filter beds, etc., have been brought more or less into use, but generally with indifferent success, and at a great cost. Some of these plans have been abandoned, and recourse had to irrigation, which is really the most economical way of disposing of sewage in an innocuous manner. The costs, however, have been very heavy, and taking into account initiatory outlay, and the rents, rates, and labour, it is obvious that sewage farms do not pay. It is indeed argued, that the expense of scavenging is saved by the system of carrying away the sewage by water, and the cost of removing the excrement and other solid matter before the new system was introduced, ammounted to a considerable sum per annum. The examples of sewage farms, which we give in the following pages, will best show the financial position of this comparatively new enterprise in the country.

Grass farms pay sewage irrigation in not a few cases, and, in the Edinburgh meadows, have been often quoted as an instance of success. It is probably from this example, which has been long before the public, that extravagant opinions of the value of sewage have arisen. Before noticing two instances of profitable grass irrigation by sewage, it may not be considered out of place to refer to the "dry earth system" of dealing with the voidances of towns and households. It was brought before the public a number of years ago by the respected Rector of Fordington and its merits have been fairly and fully tested. The principle is as old as the wilderness journey of the ancient Jews, and it is practised still in several Mahommedan countries. It also claims to fulfil all the sanitary, commercial, and agricultural requirements. It is also claimed for it by the late Rev. Mr. Moule, that it can be applied to three-fourths of the people of the United Kingdom, at one-third of the cost of the liquid system. The public have practically only accepted these views to a very limited extent, for, unless in isolated households and large institutions, the plan has not been adopted. It has been estimated that one ton of dry earth would suffice for each individual for a year, and it is applied and used in closets, very much in the same way as the water, but the mere delivery and removal of the required earth in a town would be a formidable undertaking. In villages, hamlets, and private dwellings no such difficulty exists.

The mode of dealing with sewage at Aylesbury has commanded some attention in past years from urban authorities. At a concession of £ 200 a year from the town, the Native Guano Company have savod the borough from nuisance and the risk and cost of investing in a sewage farm. By the use of natural agents, they extract and preserve the dissolved and suspended impurities of sewage by what is called the A. B. C. process. and it is sold as a dry portable manure at £8 10s. per ton There was a large show of farm and garden produce grown by this manure in October 1882 at Aylesbury, and finer samples of corn, turnips, potatoes, onions, etc., could scarcely be got together. The value of the manure was thus demonstrated to the many visitors of all classes who attendedthe exhibition. This system of sewage treatment has been in operation for seven years, with pretty satisfactory results. Votes of satisfaction have been annually passed by the Aylesbury Sanitary Authorities. The process is attended with no nuisance and the effluent water may be passed into any brook or river

Aylesbury has a population of 3000, and the daily quantity of sewage is about 250,000 gallons in dry weather, but much more in wet seasons. The name of the A. B. C. process is derived from the initial letters of the principal constituents of the precipitants,—namely, alum, blood, clay, and charcoal. The clay and charcoal, and where necessary a little lime, are finely ground up with water to form an emulsion, and mixed with the sewage; a solution of alum is then added.

The fertilising power of sewage when not overpowered with water is unquestionable, and the dried mud obtained by the purifying process would probably be threefold its actual manurial value but for the A. B. C. materials which constitute so large a part of its weight. This fact explains the reason why the dry product does not show well when tested by chemical analysis; but the good practical evidence of its value when applied in quantity is proved by many testimonials of gardeners and farmers who have been using it. The early estimates of the value of sewage were greatly exaggerated, but when it is considered that a gallon

weighs a little over 10 lbs, and that there are only 60 to 109 grains of manurial matter in the gallon (7000 grains to the pound) we arrive at sounder views as to the value of sewage and the enormous quantity of water with which manure is diluted. The liquid excreta of man, it may be stated, has a high manurial value, and as the A. B. C. process does not extract or precipitate all manures in solution, doubtless comparatively low fertilising power of the "Native guano" is partly due to that circumstance.

During an official trial on the purification of London sewage by the A. B. C. process, there were used 80 tons of dry A B C. material, whilst the native guano obtained amounted in a dry state to 131 tons, showing an increase of more than 63 per cent. The amount of sewage treated during this time was 11,672,000 gallons. Therefore one ton of dry guano was obtained from 89,100 gallons of London sewage. The quantity of materials required to purify sewage depends upon the character of the water, as well as upon the proportions of these ingredients. For the nature, too, of the manufacturing refuse of towns, the proportions of these ingredients have to be altered. As we have already said, farmers speak highly of the application of this native guano to all crops. The quantities used for the acre are very much the same as the cost of the artificial manures. For wheat a dressing of 4 to 8 cwt. is put on the acre in autumn, and oats and barely get 6 to 10 cwt. at the time of sowing. For turnips, swedes and mangels, 8 to 12 cwt. per acre, in row or broadcast, is applied to the acre.—*Transactions of the Highland and Agricultural Society of Scotland.*

ENSILAGE.

By Dr. A. P. Aitken.

The making of ensilage may be described in a word as "the preservation of green fodder." Any change which the fodder undergoes in the silo ought to be regarded as accidental, and so far an interference with the main object in view, which is not to improve the fodder, but to preserve it. If it could be brought out of the silo exactly in the same condition in which it was put in, that would be perfect ensilage, and the nearer we approach that standard in our ensiling operations the greater is our measure of success. It is not unnatural that some should have formed a higher ideal of ensilage. Enthusiastic writers describe the silo as not only a place for preserving fodder, but a kind of laboratory where it undergoes changes of a formative or elaborative kind, so that after being for some months crushed up in the dark, it is able to be brought out in a state more suitable for the nourishment of cattle. There are some coarse kinds of fodder, such as maize, whose hard tough tissues are not well-suited for cattle, nor much relished by them, and which when put into a silo, and subjected to some fermentation, are rendered softer and more palatable; but that cannot be said of the clover, vetches, and sweet grasses that form the chief ensilage in this country. It is difficult to imagine any fodder more suitable for cattle than such crops as these when cut at their juiciest and most vigorous stage. They are already the natural and choicest food of cattle, and any change which they may undergo in a silo cannot be of a constructive or elaborative kind, but rather of a destructive kind. Construction is the work going on in the body of the living plant, the materials out of which its tissues are made are derived from outside of it, from the soil and from the air, and the moving power which builds these tissues up is the energy of the sun's rays. When the plant is cut down and crushed into a dark pit, any changes which can occur are not those of building up but rather of breaking down.—*Transactions of the Highland and Agricultural Society of Scotland.*

[to be continued.]

CALCUTTA MARKET REPORT

FOR THE

MONTH OF JUNE 1885.

Imports.—The past fortnight has brought about no change in our market. The absence of any reliable information regarding the political position was completely paralysing to business. The unsettled aspect of political affairs kept shippers off the market. There has been rather more demand for some classes of Piece-Goods during the interval, but chiefly from *local* dealers. It indicates, however, a decrease of stocks in second hands, of which we ought to reap the benefit, were it not for the protracted uncertainty of the political future. While this lasts we cannot hope for much activity.

Exports.—During the fortnight under review, the *hide* market has continued stagnant. Transactions have taken place in some descriptions, but to a limited extent only. *Daccas* are not changed. The demand has shown no tendency to increase, imports are according to previous scale, and stocks are accumulating. *Durbhangas* and *Patnas* have moved off freely, and stocks of these are in consequence reduced. Holders demand higher prices even in the face of discouraging reports from home. Busines

in other sorts is dull. *Goat-Skins* are in strong demand with prices rising.

INDIGO.—Complaints of the plants suffering from the intense heat were received from all quarters. Prospects generally better. Rain has been general in Lower Bengal and in most parts of Tirhut and Champarun. This rain will do much good. Mahai will, however, not be general before the middle of July. There are no advices to report from Chuprah or the North-West.

TEA.—At the auctions held on the 11th instant, 7,700 Chests were brought forward and found buyers. There was good competition for all classes at fully previous rates. On the 18th instant minor sales consisting of 4,200 Chests took place and these Chests were all disposed of at unchanged values. Advices from the districts are more encouraging, the quality of musters continues very good.

LOOSE JUTE.—During the past fortnight there was a decline of two annas for *Loose Jute*; the market subsequently showed a tendency to recover itself and closes steady. At Serajgunge the market has shown the usual slight fluctuations. A moderate business only has been done at Naraingunje. The late general rain in the Lower Provinces has everywhere improved the prospects of the new crop of Jute.

BALED JUTE.—Little or no business has been done in old crop, enquiries from the other side being 5s to 10s. too low. A sale of 1,500 bales of New crop is reported, Red marks Rs 23-8 and ordinary firsts Rs 22, but this requires confirmation.

BUTTS.—Have been quite neglected by shippers. A few small lots have been taken by mills @ Rs 11, at which rate we quote them nominally.

REJECTIONS.—There are none at present in the market. Quotation Rs 12-10 to Rs 12-8 nominal.

JUTE MANUFACTURES.—There has been a small demand for Hessians for San Fransisco and New York. Generally the market has been very quiet: almost the only business done has been for Bombay.

COTTON.—Nothing doing, quotations nominal.

RICE.—Quotations for *Table* are unaltered. In *Moonghy* and *Kazla* there have been no transactions; prices are nominal. Prices have ruled a trifle better for *Ballum*, and a moderate business has been done in this sort.

WHEAT.—The Wheat market is steady. For Club No. I, the enquiry has been limited, and no large quantity changed hands. But for Club No. 2, the enquiry has been good, and large transactions are reported.

SEEDS.—*Linseed*: a fair amount of business has been done. Rates have steadily advanced, and close firm.

RAPE.—Nothing of interest to report. The market for this describtion is dull and depressed.

CASTOR.—Stocks and imports are small, yet at current prices buyers appeared unwilling to enter into contracts for forward deliveries. Only a small business is reported.

TEEL.—No stock.

POPPY.—A moderate business is doing, prices are firm.

NIGER.—There are no stocks in the market.

CASTOR-OIL.—Is very firm with an upward tendency.

SHELL LAC.—The Market has been in a disturbed state. The almost daily advance quoted from home caused the market to be excited. Sellers would not suit themselves to buyers, with the result that but little business was done. Subsequently prices receded a rupee from the highest point demanded, but this concession does not meet the views of shippers: a decline of another rupee is demanded before purchasers will operate.

SILK.—Owing to the good accounts of the Italian and China crops, buyers have held off the market, and nothing beyond a few odd bales have been sold. Prices are almost nominal.

SILK PIECE-GOODS.—Fair demand, stocks very small.

Freights.

This is a period of great depression. Rates have continuously declined, until now they have touched a limit which, for steamers, certainly means little short of ruin. Still the quantity of produce offering is most limited. Prices of our chief articles of export have not given way to nearly the same extent as freights, but, before business can become feasible, they must do so. This will not probably be till next month, when sufficient rain has fallen to allow those districts tapped by canals and rivers to utilise this much cheaper mode of carriage.

It does not seem unreasonable to look for a better demand when the results of the speculation which the late crisis gave rise to, have been worked off.

The State of Season and Prospects of the Crops for the Week ending 6th May, 1885.

GENERAL REMARKS:—Slight rain has fallen in a few districts in Madras and Mysore. In Bombay some rain is reported from parts of Dharwar, Belgaum and Kaladgi, and in the Punjab from the Amritsar, Lahore, Rawalpindi, Shahpore and Peshwar districts. In Bengal rain has fallen generally throughout the Province and done much good to the standing crops.

Agricultural prospects remain unchanged in Madras and continue uncertain in Mysore. In Coorg the growing crops are doing well and the prospects of the season good.

The rabi harvest is nearly over in Bombay and North-Western Provinces and Oudh; in the latter average out-turn is expected. Preparations for the Kharif are going on. In the Punjab the rabi harvest continues in active progress and Kharif sowings have commenced. Threshing and winnowing of rabi and Kharif preparations are in progress in the Central Provinces.

In the Berars and the Nizam's territories and in the Central India and Rajputana States harvest operations continue and prospects are generally good.

In Bengal the recent rain has facilitated agricultural operations and improved the prospects of the standing crops. Ploughing and sowing continue. More rain is wanted generally throughout the Province.

In Assam ploughing and sowing are in hand and prospects good.

Cholera is chiefly prevalent in parts of Bombay, Bengal and Central Provinces but public health is generally good.

Prices are generally steady except in Bengal, where the price of rice has on the whole risen.

The State of Season and Prospects of the Crops for the Week ending 26th May, 1885.

Rain has again fallen throughout the Madras Presidency, but except in the Ganjam and Kistna districts, the falls were too light to be of much benefit to the crops, which still want rain in some districts. No rain has fallen in Mysore, where prospects remain unaltered. Want of pasturage for cattle continues to be felt. In Bombay slight rain fell in 13 districts; rain has fallen also in the Punjab generally, and in parts of the North-Western Provinces and Oudh and the Central Provinces. In Bengal proper and Assam good rain has fallen generally. Rain was also general throughout the Central India and Rajputana States and prospects continue good. Agricultural prospects remain unaltered in Madras. The rabi harvest has been completed in the Central Provinces, and is approaching completion in Bombay, the Nizam's territories, the North-Western Provinces and Oudh, and the Punjab. Kharif operations are in general progress throughout these Provinces and the Berars. The recent rain has much improved the prospects of the standing crops in Bengal, and has facilitated agricultural operations. Early paddy and jute are being sown in many districts, and harvesting of boro paddy continues. Ploughing and sowing in Assam; and tea is reported to be doing well in Cachar. Cholera, small-pox, and fever are reported to a greater or less extent from most Provinces. Prices are fluctuating in the Punjab; elsewhere they are generally steady.

Madras.—General prospects fair, except in parts of Bellary and Anantapur.

Bombay.—Slight rain in parts of 13 dtstricts. Rabi harvest completed in all districts, except Shikarpur; preparation for kharif crops in progress in 9 districts; scarcity of fodder and drinking-water continues in several parts of Dharwar and Belgaum. Cholera and small-pox in parts of 13, fever in parts of 12, and cattle-disease in parts of 6 districts.

Bengal.—Rain fell almost everywhere during the first part of the week, and has facilitated agricultural operations and improved prospects of standing crops; early paddy and jute are being sown in many districts; harvesting or boro paddy still continues; mango is a poor crop. Prices of food-grains generally steady. Cholera and small-pox prevalent in many districts.

North-Western Provinces and Oudh.—Rain has fallen in most districts. Harvesting operations very nearly completed, out-turn good. Markets well supplied and prices steady. Cases of cholera reported from a few districts.

Punjab.—Rain in nearly every district. Cholera in the Umballa and Mooltan districts abating; virulent fever in a few villages of the Peshawar districts, health otherwise generally good. Rabi being harvested, out-turn in the Umballa, Sialkot, Lahore and Shahpur districts partly damaged by rain; kharif operations in progress. Prices fluctuating.

Central Provinces.—Weather hot, with occassional storms. Kharif preparations progressing. Cholera continues in Hoshangabad, Nimar, and Raipur. Prices steady.

British Burma.—Cholera which has abated in Pegu, is slightly prevalent in Akyab, Kyoukphyoo Thongwa, and Amherst; some cases of small-pox in Kyoukphyoo and Tharrawaddey; otherwise public health generally good. Cattle-disease prevalent in 3 districts. Rain has fallen in most districts. Weather cooler.

The State of Season and Prospects of the Crops for the Week ending 3rd June, 1885.

General Remarks.—Rain has been general in the Madras Presidency, and prospects are reported to have improved in Bellary and Anantapur, where they have been very unsatisfactory for some time past. Railway relief works have been stopped in Bellary. In Mysore rain has been general throughout the State, benefiting the standing crops and increasing the water-supply. The prospects of the season are improving, and ploughing and sowing are in progress

In Bombay rain has fallen in parts of several districts. The rabi harvest has been completed, and kharif sowings have commenced in places. Scarcity of drinking-water and of fodder still continues in parts of Dharwar. In the Central Provinces the weather is hot, with occasional storms and showers. Kharif ploughing is in progress. Some rain has also fallen in the Berars and the Nizam's territories, where kharif preparations are in hand. In the Central India and Rajputana States there was little or no rain, but prospects continue generally good. The weather is seasonable in the North-Western Provinces and Oudh; the rabi harvest has been completed, and markets are well supplied. In the Punjab rain has been general. The rabi out-turn in some districts has been damaged to some extent by rain. Kharif operations have commenced.

Some rain has fallen in parts of Bengal, but more is wanted generally. Agricultural operations are much retarded, and the standing crops are withering. Scarcity of drinking-water is also beginning to be felt in places. Rain fell throughout Assam but more is wanted in some districts. Ploughing and sowing continue. The prospects of tea are somewhat unfavourable in Sylhet, Cachar, and Dibrugarh.

In British Burma rain has fallen in every district, but not in sufficient quantities to allow ploughing operations to be commenced. Cholera, fever, and small-pox are prevalent in most districts of Bombay and Bengal, and are reported to some extent from other Provinces. Otherwise the public health is generally good.

Prices continue high in Bengal, and are reported to be still rising in some places. Elsewhere prices are generally steady.

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THE Government of India have placed at our disposal a report on the Alon Farm in British Burma. The period covered by the report extends over six months from September 1884, when the agricultural experiments discontinued at the end of January were resumed. Experiments were made on rice-growing both with and without manures. The land was divided into plots, two of which received no manures, and the third which had received bone-dust in 1883 received the same treatment over half of it, the other half being left unmanured. The quantity of bone-dust used was at the rate of 10 cwt. per acre, being double of that used in the previous year. The 4th plot which had received an application of dissolved bones in 1883 had the same treatment in the year under review over one-half of it, the other half being left unmanured. The manured half of this plot got also a dose of conservancy manure at the rate of 120 carts per acre. The 5th plot was manured with 110lbs. of nitrate of potash in 1883 and the dose was doubled in 1884. The dissolved-bone-plot gave the best result, but the addition of conservancy manure made no difference. The conservancy manure, however, as added in another paragraph, was most likely washed out by the overflow of the water. The plot with ground-bones came next, but the extra supply did not produce a proportionate increase in the crop. The nitrate-of-potash-plot this year gave a lower result than the unmanured, whilst last year it was almost equal to the dissolved-bone plot. The unmanured plots gave practically the same results as last year. The report under notice does not however enter into detail as to the method and time of application of the manures, without which it is impossible to form any idea of the relative merits of the manures. Nitrate of potash, for instance, is a very diffusible substance and, if not applied at the time when plants are in forward condition and capable of utilising the salt, is readily washed down into the sub-soil beyond the reach of the roots of agricultural plants. It is also not clear from the report that the nitrate-of-potash-plot had received the same treatment previous to 1883. If so, there might be some fear of exhaustion on that score, but the application of the nitrate for one or two years only has very little likelihood of exhausting the soil. But supposing that the continued application of nitrate of potash had diminished the stock of fertility in the soil, which is not very unlikely, we should like to see bone-dust or better still dissolved bones used at the rate of 8 cwt. per acre along with nitrate of potash. The officer in charge of the farm intends to try the effect of lime on the soil and we hope he would take our suggestion of trying dissolved bones with nitrate.

* * *

BESIDES rice, experiments were also made with Sugar-cane, Jute and Sorghum. There were six plots planted with sugar-cane in December 1884. The manures were (1) bone-dust and nitrate of potash, (2) bone-dust and chloride of potassium, (3) dissolved bone and chloride of potassium, (4) dissolved bone and nitrate of potash, (5) dissolved bone and nitrate of potash after lime. At the time when the report was written, the sugar-cane was not fit to cut, but the plots manured with dissolved bones and nitrate of potash after lime looked the best. The jute planted in 1883 failed, because of the wetness of the soil. In 1884 the experiment was repeated in a drier situation. The manures used were nitrate of soda and nitrate of potash. There was no difference in the result. The jute attained a height of 5 to 6 feet, when

it flowered; very little of it however was fit for making fibre. From this Mr. Romanis, the officer in charge, infers that the soil is deficient in lime. After the jute was cut the ground was prepared for Sorghum. There were five plots, two were unmanured and the remaining three variously manured with artificial manures. They were planted in October, the canes were cut from time to time, the juice expressed and the sugar determined, but the results were far from satisfactory.

* * *

At the ordinary general meeting of the Agri-Horticultural Society of India held on Wednesday, the 24th June, a communication was read from Mr. D. B. Allen, C.S., Bankipore, enquiring if Eucalyptus is likely to grow well in the Barh Sub-division of Patna District and requesting to be put in the way of procuring some seed as well as instructions for the best mode of cultivating them. Small quantities of the seed of three varieties—Eucalyptus rostrata, E. resinifera, and E. globulus—were sent to Mr. Allen with instructions for sowing. A report was also received on English Potatoe seed which was sent for trial in the very favourable climate of Nepal. The result is very disappointing and compares very unfavourably with those recorded by Mr. Anderson of Bancoorah. The subject of insect attack (Aphidæ) on tea-leaves was also brought to the notice of the meeting and Mr. Claude J. Dumaine was asked to communicate his own experience, who suggests that fumigating with Mohwa oilcake, if done immediately on the first appearance of insect pests, while still affecting small areas, might be usefully tried by tea-planters. Mr. N. Whyte of Raneegunj made a report on an experimental silo as well as on the growth of early Amber Sorghum. With reference to the latter he was was informed that according to the information at the disposal of the society, the point requiring the greatest care in making sugar from Sorghums is the time at which the cane should be cut. In the experiment conducted at the Government farm at Cawnpur during 1883, some 18 to 20 maunds of *gur* were made without the addition of lime, yet the juice was manipulated with the same ease as that of the sugarcane. With reference to the silo he reported that the silo which was made of brick was filled with grass (Reana Luxurians) on the 14th of October 1884 and was opened on the 15th of April this year. On opening, the fodder was not only found to be in a perfect state of preservation, but the cattle to which it was given ate it so eagerly as to convince the ryots to whom they belonged of their appreciation of it. He also mentions that parts of the districts of Burdwan and Bancoora are perhaps more in want of a system of storing fodder than any other place in Bengal, for, from the middle of March till the rains set in, the grass in the laterite soil of those parts gets quite burnt and withered and can barely sustain life in cattle, who are thus reduced to skin and bone just at the time when the heavy work of ploughing the paddy-land commences.

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It has on many occasions been supposed that the Indian salt-duty prevents cultivators giving to their cattle a due allowance of salt. The salt-duty in Burma is one-tenth of the present duty in other provinces of the Indian Empire and it seemed to the Chief Commissioner of Burma interesting to enquire whether Burmese owners usually give salt to their cattle. The result of the enquiry is that Burmans do not give salt regularly or usually to their cattle. They often, however, give a little salt to buffaloes or oxen that are working particularly hard or are plying in the sun. In tracts where cattle are fed on straw, salt is more frequently given. In the delta and in places where the soil is impregnated with salt, cattle often resort to salt-licks. It would seem that salt is given more usually to cattle plying with cart than to plough-cattle employed in the fields.

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The addition to the Government Cinchona plantation in Bengal of 174, 800 trees of the quinine-yielding cinchonas known as *Calisaya Verde* and *Calisaya Morada* is the most interesting feature in the operations of the year 1883-84. These trees have been raised from Bolivian seeds which produce some of the finest of the yellow bark of commerce. Another satisfactory feature is the extension of the rich variety of yellow bark known as *Ledgeriana.* Of this variety no less than 231, 900 trees were planted out, while the hybrid cinchonas were increased by 64, 600. Altogether a considerable advance has been made towards the substitution of quinine-producing trees for the sorts yielding the less valuable alkaloids. Dr. King, the Superintendent of Cinchona plantation in Bengal, again notices the continued failure of the Carthagena bark, which he thinks will never be successfully grown in Sikkim. A quantity of *Remija* seed, which produces a quinine-yielding bark under the same of *Cuprea*, was obtained from South America, and some 40 seedlings have been raised. The plants do not look altogether healthy, and it is feared that the climate of Sikkim will not suit their growth. The demand for cinchona seeds and seedlings has greatly fallen off in consequence of the low prices that have ruled for bark during the last two years. The surplus seed of the *Calisaya Ledgeriana* was as usual distributed during the year gratuitously among applicants.

THE various kinds of horses seen in Persia are the Turkoman, the Karabagh, the pure Arab, and the Shiraz or Gulf-Arab, and their crosses: these are the horses of breed. The Turkoman horse is a tall, bony, and ungainly animal, often over seventeen hands high, never under fifteen; the head is large and the ears long. They have no barrel, and are generally "tucked up." The mane, naturally very short, is entirely shaven or burned off, and the tails are very scanty. But the Turkoman horse, though not fleet, has wonderful stay. He will, with his loose canter, cover a hundred miles a day for ten days. The Turkoman horse, however, is seldom seen south of Teheran, and is never exported to India, where he would stand no chance in the market with his more handsome rival the Australian-bred horse, the handsome, big, but usually vicious "Waler." The Karabagh horse, running from fourteen and a half to fifteen and a half hands, is the favourite of the Persian exporting dealer. He is very similar to the "Waler" in appearance, much cheaper in price, and finds a ready market. He is a bad imitation of the English hunter; handy and fairly good-tempered, never ailing in an Indian climate, and usually a weight-carrier. He is generally a bay with black points. He always has a black mark running from the mane to the tail, and often another at the withers. He is generally bought as an officer's charger or as a cavalry remount; while, if with a good shoulder, he frequently goes into the artillery. The Arab is too well known to need description; he is everything that can be desired in a horse: his only weak points are want of size, and daintiness; his temper is angelic; he is usually grey in colour. The Gulf-Arabs, so called in India because they are shipped from the Persian Gulf, are a cross between big Persian mares and the smaller but better-bred Arab horses. They are really, excluding the Arabs, the best horses in the country: having all the good points of the pure Arab horse, and in addition what he has not—size. They are sure-footed, never sick or sorry, will go over the roughest ground at speed and are full of spirit. They cost from eighteen to twenty pounds in Persia at a minimum.

NONE but entire horses are exported from Persia. Save as carriage-horses, geldings are never seen; and as a rule a Persian will never sell a mare unless she be barren. The finest horses in Persia are bred by the Eeliauts, or wandering tribes. The wealth of these people consists entirely of cattle, sheep, and horses: they wander from their winter quarters in the plains, to their summer quarters or *yeilaks* in the mountains; each tribe and each famliy having its recognized grazing-ground, and its spring or share of one. Besides the horses mentioned, the ordinary *yabu*, or pony of Persia, which is of too little intrinsic value for export, is not an animal to be despised. He is strong, under fourteen hands, of no breed in particular, unless he happens to belong to the race of "punches" found in Ispahan. These animals are cobs of great power, short-legged, big-barrelled, never over fourteen hands (generally less). They will carry immense burdens, and are much valued in Ispahan as amblers and for the purpose of crossing with asses to produce mules. And the Persian mule in his way is perfect—*i. e*, as a hardy beast of burden. The "punch" of Ispahan is heavy, big-headed, with ample main and tail, and is usually hairy under the jaw.

A PROJECT has been put forward at Amsterdam, the object of which is to supply London with milk. The scheme provides for the building of four ships of 720 tons each, to convey over 50,000 quarts of fresh Dutch milk to Harwich from Amsterdam. Ice is to be largely employed in transit. The company will have a capital of £141,666, and the promoters say that if only 50,000 quarts of milk could be sold in London at 2¾d per quart there could be a revenue of £34,400, or 24 per cent. The milk supply of Calcutta is notoriously bad. Any one having enterprize enough to open a dairy farm in or near Calcutta will fill up a great want and confer a substantial boon to the town.

THERE was a remarkable falling off in the amount of irrigation in the North-West Provinces during the *rabi* season of last year. The area irrigated was 843,708 acres which was less than that of 1883-84 by, 628,226. The amount of irrigation is the smallest that has been recorded since 1877-78. The decrease is almost confined to the region served by the four large canals of the province, the Upper and Lower Ganges, the Agra, and eastern Jumna Canals. In 1883-84 the revenue was upwards of thirty one lakhs; last year it fell to seventeen. This great difference is entirely due to the fact that the season was a wet one, while the previous one was remarkably dry. A similar decrease occurred in 1879-80, and was followed by a rapid recovery, so that there is good reason to believe that the present falling off is only temporary.

Mr. R. A. Mack, of the Agricultural Department in British Burma, has lately published an interesting report on the various gamboge trees growing in that province which are so-called from the colour obtained from the gum exuded by them. There seem to be three principal gum-producing trees, but only one of these, which is known as the Tawmengoot, yields a gum of any commercial value; the gum of the others contains too much resin, not being soluble in water, and, when made into varnish, becoming sticky in hot weather. Samples of three different gums were sometime ago sent to Calcutta for valuation and analysis, but the report on them shows that there is a little hope at present of the Burma gamboge becoming an article of commerce in the Calcutta market. In refined state, gamboge sells in the Calcutta market at Rs. 2 to Rs. 2-8 per seer, whilst it appears that in British Burma the cost of collection alone amounts to nearly Rs. 7 per pound. Until this expense, therefore, is very considerably reduced, the trade in gamboge between Burma and Calcutta is not likely to flourish. It is said that the same kinds of plants are found in the Madras Presidency, in Wynaad, parts of Coorg and Mysore, and the Madras Agricultural Department has been directed to make enquiries on the subject. Indian gums are not as yet well known, but it is believed that they will soon attract attention on account of their commercial importance—Englishman.

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We learn from the Bombay Gazette that Lord Reay accompanied by the Hon. Mr. Melvill, Mr. Ozanne, the Director of Agriculture, and Mr. Wallinger, Conservator of Forests, went to see one of several experiments designed by Mr. Ozanne to test various kinds of rab and their value. His Excellency having inspected a collecton of all instruments used in rice cultivation, drove to the plots where the rab had been grown in the hot weather and exanined the seedlings. His Excellency will now be able to form his own opinion on the much discussed question of the value of rab. As a full history of rab and its importance to agriculture will appear in the pages of this journal, we reserve our comments on it.

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The following is from the Bombay Gazette:—Mr. Nanabhai Jasbhai, Dewan of Cutch, addresses us to-day on the subject of the art-industries of India. His letter has been called forth by the report of a recent gathering in Bombay, at which an account was given of the experiences of a young Hindu, Mr. Rajwade, who had lately returned from the United State, whither he had been sent at the expense of some enterprising member of his community, in order to learn some useful hadicrafts. Mr. Nanabhai's object is to insist upon the importance to India of encouraging the arts and industrial workmanship of the country, and he reminds us what the out-of-the-way State of Cutch, despite its isolation from the busy life of this part of the presidency, has done in this useful cause. The young Rao has gone on precisely the same lines as the enlightened gentlemen who sent Mr. Rajwade to America. He signalised his installation on the *gadi* by establishing a scholarship for a student who would go to Europe or America for the acquirement of such liberal or technical education as might from time to time be decided upon by the Cutch State. For this scholarthip, the Dewan tells us there have been no fewer than twenty-two applications, of which nine were from this presidency. Evidently, then, there is abundant readiness on the part of the people of the country to take part in the movement, provided that men of wealth and influence will give such encouragement as is necessray.

Colonel Hay, in charge of the Amrat Mahal Department, has obtained the sanction of the Dewan to the formation of experimental farms in Mysore, for the cultivation of guinea and other grasses, and the storing of green fodder in silos to provide wholesome forage for cattle during the hot season, the scarcity of fodder during the past season having proved such a great calamity. Rs. 1500 has been sanctioned for the purpose. A recent experiment with a silo on the Kungal farm was productive of excellent results.

Mr. A. K. Ray, who went to England in December 1882 with the Government Agricultural Scholarship to study at the Royal Agricultural College of Cirencester, has very recently come back amongst us after graduating with honors in the above College. For having passed with distinction in the practice and science of Veterinary, he also obtained one of the two prizes founded by Sir Rivers Thompson. On the eve of his departure for India Mr. Ray went in for the Diploma Examination held annually by the Royal Agricultural Society of England, in virtue of passing which he got a prize of £10 and was elected an honorary life member of the Society. In fact, he has secured some of the highest agricultural honors available in Great Britain. His native land expects to be benefited by the stock of useful knowledge which he had been at such great pains to gather and towards which the country contributed; and we confidently count upon Mr. Ray to realize the expectation.

The supplement to the Calcutta Gazette of the 8th Instant publishes a letter from Mr. Hallen, Inspecting Veterinary Surgeon and General Superintendent, Horse-Breeding operations in India, describing the method of cattle-vaccination as practised in M. Pasteur's Laboratory in Paris. The measures adopted in detecting and cultivating anthrax germs, and attenuating the *virus*, so as to render the latter of the first and second strength, were fully explained and demonstrated to him. The operation of vaccination in sheep, cattle and horses was also pointed out to him. It has been most fully proved that animals duly vaccinated with properly prepared *virus* become protected from anthrax, that in France and neighbouring countries the system is becoming generally adopted and that heavy loss among stock is gradually more and more prevented. He also visited a laboratory in Edinburgh where most valuable experiments as regards disease-germs and their culture were being carried on.

From his enquiry he is fully convinced of the usefulness of the system of vaccination as protection from anthrax and similar zyomotic diseases which claim among their victims thousands of cattle, sheep and horses every year. He urges the necessity of having local laboratories where virus may be attenuated and made ready for vaccination. These laboratories will afford opportunities of not only providing vaccinating matter for anthrax but will also allow of experiments being carried on with reference to other zyomotic infectious diseases of stock, such as reinderpest, foot and mouth disease, pleuro-pneumonia, etc.

In an appendix attached to his letter he describes in detail the process of vaccination as actually practised. The operation itself is very simple, and, provided the vaccine matter is duly prepared, can be done by any veterinary surgeon. The importance of cattle to agriculture and to public in general can not be over-rated. As various kinds of cattle diseases causing great havoc amongst cattle seriously interferes with agricultural operations, early attention should be paid to the subject and steps taken to give effect to the proposals of Mr. Hallen.

In a note on ploughs and ploughing in Burma by F. W. Cabaniss, Assistant Director of Agriculture, British Burma, the failure to introduce successfully improved useful agricultural implements from Europe and America into India has been said to be due to two causes, namely (1) that the requirements of the country were not known and (2) that the art of working the implement introduced was not understood by the party to whom it was sent to instruct the cultivator in its use. Often it has been the case that the instructor has been unable to use the new implement, as well as the cultivator used his crude home-made implement, the art of which crude implement the instructor himself was perfectly ignorant of. The district officials were in many cases the best available instructors to whom government could entrust it for practical trial, and it would not be fair to blame them, for never had they any occasion to learn the use of any agricultural implement. The best course for the Government would be to engage the services of those who are specially trained or have trained themselves for such purposes.

America, according to the writer, appears to be the country to which East must look for improvements in agriculture and agricultural implements, owing to its geographical situation, to the interest taken in agriculture and to the tendency of its people to cultivate the soil as cheaply as possible by the use of the best machinery and implements. For both America and India, the best implement to commence cultivation with is the *turn-plough*. It turns the soil to one side and either inverts or partially inverts the soil. The top and the bottom of the furrow is about the same width. If the soil is entirely inverted, hard rain will cause it to run together and become hard again earlier than if it was partially turned. If there is grass on the surface and the seed will be sown in a short time, it is best to turn the soil over completely and thus destroy the grass.

Our foreign trade for the twelve months ended the 31st March last shows an increase over that of the previous year of nearly one crore of rupees. The value of import was Rs. 5,51,12,738 as against Rs. 5,50,90,528 and that of exports Rs. 6,12,23,487 as against Rs. 5,25,72,523. Excepting Cashmere, Ladak, Thibet, Sikkim, Bhutan and Upper Burma, there was a decrease in the value of imports from all other countries. There was an increase in the value of exports to Cashmere, Ladak, Thibet, and Khelat but only of small amount. On the whole the foreign trade has been flourishing.

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The third number of *Petermann's Mitheilungen* for this year contains an article by Herr A. Woeikof on the influence of forests on climate. The following

is a summary of the translation given by the Englishman :—As a general rule it may be laid down that on the warm seasons, as between forests and places close at hand which are treeless, (1) the temperatures of the earth and the air are lower in the former, (2) their variations are less, and (3) the relative humidity is greater. The influence of forests in diminishing evaporation from water and soil is so great that it cannot be accounted for alone by the lower temperature of the hot months, the greater humidity or even by the shade. An important influence, hitherto but little appreciated, is the protection from wind afforded by the trees and this the writer regards as more important than all the others together in reducing the degree of evaporation.

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THE Director of Agriculture, Bengal, has kindly favoured us with a copy of a note on the subject of "Hints on Ensilage," of which D. B. Allen is the author. Most of the points in the note have been described in detail in the article headed "Ensilage" which appeared in the last issue of this Gazette and need not be reprinted in this. A few points, however, are of special interest for their practical bearing. This system of storing food may be used advantageously for rendering more palatable hard and indigestible stuff, such as *makai* or *kodo* stalks which in the raw state are of little value as food for stock. Again the best ensilage on a large scale might probably be made in an indigo vat. An abandoned mud hut with walls thick enough to withstand the pressure might be cheaply converted, into a silo. Mr. Burrows, of Beheea, has constructed one this year, with walls four feet thick at the base, gradually narrowing to 2½ feet at the summit. Rude mud steps built up against the wall outside enable the labourers to carry the fodder to the top of the silo. The plan followed at Cawnpur of burning some rubbish in the silo just before filling so as to harden the walls and to kill all weeds and insects seems to be sensible and should be adopted. About 100 lbs. to the square foot, that is, a foot of earth all over the surface is, according to the author of the note, quite enough weight even for hard stuff.

CHINCHLI, a town in the Native State of Kolhapur, holds an annual Agricultural Show, of which the last one held on the 31st January 1885 was the third of its kind. His Highness the young Maharajah presided at the Durbar held on the occassion in the show-yard. The number of horses, oxen, buffaloes and sheep exhibited were 339 as against 388 of 1884 while the number of animals that got prize were 103 as against 97 of previous year. A new feature of the show this year was the exhibition of agricultural products. It is very gratifying to see that Native States following in the wake of the Government have been looking out in the direction of agricultural improvements in their States and instituting agricultural shows. In India where princes down to peasants are extremely suspicious of innovations, Government shall have to lead in such matters and the people will slowly but surely follow in their footsteps.

FROM the accounts of the Trade and Navigation of British India for the first two months of the present financial year, as compared with those of the corresponding period of last year, it appears that the total value of merchandise imported was Rs 8,21,59,305, as against Rs 9,66,09.906, and that of merchandise exported Rs 16,24,88,420, as against Rs 17,70,96,603. The value of treasure imported was Rs 3,69,63,651, as against Rs 3,01,38,685, and that of treasure exported Rs 7,60,400, as against Rs 45,15,280. The gross amount of import duty collected, including salt duty, was Rs 31,16,122, as against Rs 36,72,172, and that of export duty collected Rs 14,31,381, as against Rs 13,19,085. Regarding the decrease in imports, which, excluding Government stores, amounted to Rs 1,58,42,992, we see that it occurred under every heading in the list with the exception of raw materials and unmanufactured articles and railway plant and rolling-stock; whilst, on the export side, the decrease, which amounted to Rs 1,48,43, 320, was almost entirely in raw materials and unmanufactured articles. On the other hand there was a considerable increase under the heading of articles of food and drink and other manufactured articles, but the above figures fully justify the complaint of the general dulness of trade during the two months under notice.

AT present the price of silk is said to be lower than at any time since the French Revolution in 1848. In a great measure the glut in the English silk market has been due to the enormous imports from China during the present year. For the last eleven months of 1884 the imports of China silk were 30,698 bales, as compared with 12,789 bales in the corresponding period of 1883, and the cause of this is very obvious. The Chinese dealers and merchants were in such a fear of damage from French arms on the one side, of internal exactions on the other, and of plunder from third parties in a time of panic, that they preferred to sell off their stocks at low prices. The stocks of

China silk in London amount to 28,000 bales, valued at nearly two millions sterling.

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The reclamation of the sandy wastes along the sea coast of Madras, by the formation of casuarina plantations, is proceeding steadily from year to year. The trees grow kindly in what appears to be pure sand, and the nearer they are to the sea, the more they seem to flourish. The casuarina plantations now form a marked feature in the scenery from Tanjore to Madras; and along the coast of northern districts, they are even finer than in the south. The tree is a very pretty one, and looks some-what like a tasselled fir, the foliage contrasting vividly with the very red colour of the sandy soil in which the plantations usually stand. They grow to a considerable height, and add greatly to the beauty of the country. The yield of the casuarina, after ten years growth, has been found to be about 90 tons per acre, and it is a fortunate circumstance, that close planting gives the heaviest yield. Careless planting is, however, very fatal; as in such cases, the roots are apt to become tied into a knot, and the sapling then naturally dies off. Mr. Vincent, who was for many years a forest officer in the Punjab, has now introduced a system of putting seedlings, which are about to be transplanted, in palmyra baskets, which are placed in the ground with the plants. This is found to be far more effectual than transplatning the young trees as if they were rice plants. It is curious, that the name of the officer who first introduced the casuarina trees into Madras, should have been completely forgotten.

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The most interesting feature in the operations of last year in connection with Chincona planting in Bengal, was the addition to the plantation of 174,800 trees of one of the best quinine-yielding cinchonas. These trees were raised from seed supplied by the Secretary of State in 1882-83, but it is yet too early to say whether they will prove successful in Sikkim, although their present appearance is described as healthy. Of another rich variety of cinchona, 231,900 trees were planted out, while the hybrid varieties were increased by 64,900. The total number of trees of all kinds on the plantation, at the end of the year, was 4,912,111, and the crop amounted to 339,801 lbs. of dry bark, nearly the whole of which was made over to the Febrifuge Factory for disposal. The total sum spent by the Bengal Government on cinchona plantations and factory since 1862, has been Rs. 10,84,202, which it is stated has been recouped more than twice over, by the saving effected by the substitution of cinchona febrifuge for quinine in Government medical institutions.

A resolution has been issued by the Bombay Government regarding the survey settlement of forty villages of the Honavar taluka of the Kanara collectorate, five of which fall within the limits of the Bhatkal sub-division. The Survey and Settlement Commissioner proposes that the villages be divided into four groups, the first consisting of four in the vicinity of Honavar, and two adjoining the Murdeshvar harbour, with a maximum dry crop rate of twelve annas and a maximum rice land rate of Rs. 6-8; the second consisting of two villages on the Shiravati river and the coast, with a maximum dry crop rate of twelve annas, and a maximum rice land rate of Rs. 6-0; the third, consisting of ten villages more inland, with a maximum dry crop rate of ten annas, and a maximum rice land rate of Rs. 5; and the fourth consisting of two hilly villages, which are least accessible, with a maximum dry crop rate of ten annas and a maximum rice land rate of Rs. 4-8. It is proposed that a maximum rate of Rs. 12 be adopted in all the groups for mixed cocoanut and supari gardens and a maximum rate of Rs 10 for cocoanut gardens. The Governor in Council is of opinion that the grouping is very judicious, and the rates which are similar to those which have been successfully introduced into adjoining villages, are sanctioned. The aggregate increase in the assessment is 42·25 per cent., but as usual in the Kanara settlements the result varies very widely in different villages. In accordance with the orders contained in a Government resolution of the 25th October 1874, only 50 per cent. of the increase will be levied in the year, and 75 per cent. in 1886-87 in villages in which the new assessment exceeds the old by 80 per cent.

The Punjab Government in a report on the wheat trade of the country makes the following pertinent remarks:—The chief drawback lies in the dirty condition of the grain, and its being mixed with inferior grains; but as the cultivator receives the same price from the middle-man for his grain, whether it be clean or dirty, he has at present no inducement to turn it out in a clean state. This, unfortunately, is not a matter in which outside interference is likely to be of much avail, and Sir Charles Aitchison believes that the Government must look rather to the self-interest of the class, and to the example set by western enterprise. The trader, it is said, will desist from these malpractices, when he finds that 1,000 tons of wheat, which he despatched from Lahore, have been cleaned and

examined at Kurrachee, and that he only gets payment for 950 tons; and that too, classed low for mixing. Various minor difficulties in the way of the trade are also enumerated, which are mostly capable of either partial or entire removal. Among the practicable measures for the encouragement and improvement of wheat-cultivation, Sir Charles Aitchison believes in the distribution of broad-sheets, urging the cultivation of better wheat. His Honor desires that a well considered and practical broad-sheet should be prepared in the Agricultural Department, on the cultivation, harvesting, and storing of wheat and it should be made available for distribution in the various dialects of the province, to all zaildars, village headmen, and putwaries. Notwithstanding how little has as yet been done for the wheat trade, it has already expanded in a truly surprising manner, and it is hoped that the completion of the Sukkur bridge, which has been described as "the link now wanting between the granaries of the Punjab and the seaboard," will give it yet another impetus, by effecting a saving both in time and money. We have tried to show in the pages of this Gazette that the introduction of the hired system of steam-threshing seems to be a likely means of remedying the evil.

AGRICULTURAL IMPROVEMENT.

In this article, we propose, to make a few suggestions regarding the improvement of agriculture in India. In dealing with the subject we will be as brief as possible, being extremely anxious not to take up too much of the valuable time of our readers as well as of our own. We will first point out what we think to be the requirements in effecting any improvement on the existing system of agriculture in India under the four heads of,

I.—Collection of agricultural facts

II.—Experiments to be made to find out the natural laws affecting the agricultural operations in India.

III.—Application of these laws to agricultural practices.

IV.—Diffusion of a better knowledge of the theory and practice of agriculture.

We will then under each head make a few suggestions as to the best way, in our opinion, to meet these requirements.

Requirements:—

I.—Collection of agricultural facts: Under this head we will take no notice of such facts as belong properly to agricultural statistics as the importance of the latter subject has already been recognised and the Government has established a separate department for the collection and publication of such facts. There is another class of facts for the collection of which no systematic attempt has yet been made and of which our knowledge is extremely limited, but which of all things must first be known before any thing could be done for the improvement of agriculture of India, or of that of any country whatever. Before we can expect to make any improvement on the existing system of agriculture, we must have an accurate knowledge of what that system is. In other words, we must know as much as is known to the best of the Indian cultivators regarding tillage operation, adaptation of the crops to different varieties of soils and climate, rotation and disease of crops, physical indication of the nature of soils, in fact, we must thoroughly acquaint ourselves with all that practical knowledge of agricultural operations which the Indian ryots have acquired through the experience of generations without number. This, no doubt, is a laborious and difficult task, but there can be no difference of opinion as to its importance. It is not in India alone that a disregard of this preliminary work, has been the cause of the failure of many earnest attempts at agricultural reforms.

Considering the nature of the task and also of the difficulty in obtaining an intelligible answer from the Indian peasants to any question put to them, it is evident that for the collection of such facts as are referred to above, we want men well trained up for the purpose, and the method employed for carrying out our object must be other than that of putting direct questions to the ryots and recording the answers given by them.

II.—Experiments: After we have obtained an accurate knowledge of the existing systems of agriculture, our next effort should be directed towards making a series of systematic experiments, well devised and performed with all the accuracy physical investigations are capable of. Of late much has been written and a great deal more said in derision of agricultural experiments. This has been partly owing to the experiments having been in the majority of cases made in a very careless way and partly also owing to a misunderstanding as regards the object of such experiments. However this might be, there can be no question as to the importance, nay the absolute necessity of such experiments. There is only one way of learning laws of nature, be they intended for improving any industrial art or simply to add to the stock of our knowledge and that is by making proper experiments and rightly interpreting them. It will be necessary to make experiments in order to find out whether what the Indian ryots have accepted as

facts are really so. Experiments can alone tell us how far the most valuable of the so called artificial manures that have proved such a great help to the English farmers, will be suited to the soil and climate of different parts of India. To improve the mode of cultivation of the existing crops and to introduce new crops from foreign countries as well as from the forests and jungles of our own, the first step to be taken is to make experiments. Another series of experiments ought to be made not so much for the immediate use that could be made of them in agricultural operations as for extending our scientific knowledge of the morphology and physiology of plants.

All these experiments are to be carried on partly in the field and partly in the laboratory. An example will make this point clearer than any thing else. Suppose our object be to find out the the manurial value of ashes to potatoes. It would not do simply to take a measured plot of land, apply to it so much by weight of ashes and grow potatoes on it, and then at the proper season to dry out the potatoes and weigh them. To form an accurate idea of the thing we must know exactly the composition of the particular sample of ashes we have to use and for this we must have recourse to the laboratory. We must know the nature of the soil and its composition as far as this could be revealed by our present method of analysis. When the potatoes have been gathered, these should be carefully weighed and a few well selected ones of average quality should be subjected to analysis in order to find out their chemical composition and as far as possible their nutritive value. As the present methods of chemical analysis fail to shew the true agricultural value of different kinds of soil, it will be necessary for us to take recourse to the method of elimination. To do this, we shall have to select another plot of land close to the manure plot and as far as possible of the same nature. This plot should also be planted with potatoes and the two pieces should as for as possible receive the same treatment. At different stages of the growth of the plant, the meterological conditions of the atmosphere, *viz.* the rainfall, temperature, hygrometric condition, duration and intensity of sunshine, and the direction and velocity of the wind should also be carefully recorded.

[to be continued.]

DEMONSTRATION FARMS.

The term Demonstration Farm was introduced by Mr. Smeaton, Director of Agriculture in North-West Provinces, to describe a kind of farm which he wished to establish in order to give publicity to those experiments which had been proved at the Cawnpur Farm to be of undoubted advantages in increasing production and, also from their simplicity, fit for acceptance by the mass of cultivators. For the past seven years experimental operations have been carried on at Cawnpur with varying success. There have been numerous failures, but, on the other hand, certain processes have, according to Mr. Smeaton, been proved beyond doubt to be beneficial in increasing production. Of these the following are expected to commend themselves at once to the agricultural classes if only sufficient publicity be given them, and sufficient pains be taken to induce the cultivators to make the first essay.

a. Inversion of the soil with a cheap improved plough.

b. Manuring for wheat by ploughing in hemp green.

c. Cultivation of Mozaffernagar wheat.

d. Cultivation of Cape oats, American cotton, sorghum and white linseed.

e. Ensilage of green fodder.

Now if Mr. Smeaton is right, and he speaks positively, the sooner this gospel of agricultural salvation is preached and practised all over India the better.

Those who know of the patient work that was carried on at Rothamsted for a much longer period than seven years, before the scientific men in charge presumed to speak authoritatively on the results of similar experiments, may well hesitate before sharing in Mr. Smeaton's confidence, but fortunately the very method which is proposed for demonstrating the beauty of these experiments will supply additional evidence either for or against them. The idea is, to establish a farm of twenty acres with an apprentice trained at Cawnpur as manager, who would cultivate this area to the best advantage, putting in practice such of the improved processes, and using such of the new implements as might be judged suitable, and working the farm on strict commercial principles. His operations would be daily on view to all comers, and he would answer all questions about his methods. He would also visit surrounding villages and invite inspection of his modes of cultivation and accounts.

It has been the fashion for Sir Ashley Eden and his followers in Bengal to poke fun at the Cawnpur Farm, and the absence of all practical results from the operations of the Agricultural Department in the North West Provinces: but here we have a most practical suggestion which assuming, as is likely, that Mr. Smeaton's views as to the value of these experiments are correct, should lead to real practical benefits for the cultivators of India.

The Maharaja of Dumraon has lately determined to try a Demonstration Farm on his own account and in the hope that others may be induced to follow his example. I send you an outline of the procedure that it is proposed to adopt.

An area of about twelve acres has been fenced off from the *zerats* near Dumraon. This is to be divided into fifteen pairs of duplicate plots. Each of these pairs is intended to show the advantage (if any) of an improved system of cultivation over the ordinary native method.

For instance, one plot will be cultivated with an improved plough, while its fellow will be treated in the usual way. Of another pair one will be sown with selected, and the other with common seed. Other experiments will tend to show the advantages of different manures on similar plots lying side by side and subject to the same climatic influences. The outturn of the different plots will be weighed and as accounts will be kept showing the cost of cultivation of each plot, it will be easy to see whether the increased outturn is enough to render any particular system economical or not.

Different systems will be tried on separate plots, so that it will be possible to ascribe an increased outturn to the proper cause.

In a few years the Maharaja will be able to convince himself as to which of these experiments it will pay him to adopt on the rest of his *zerats*; and his tenants will be ready enough to follow his example. It is easy to call the Indian ryot slow and prejudiced but when once a process is proved to be advantageous he will be quick enough to adopt it. It is not strange that he is slow to hear the agricultural missionaries who visit the fairs in the North-West Provinces, armed with improved ploughs and new fangled water wheels; for they can only talk, or, if they do carry out successfully some simple experiment, the result is sure to be ascribed by the wondering audience either to *jadu* or, *masala*. But when they see their own Maharaja trying these experiments on a large scale, there will be no hesitation nor prejudice; for he will speak to them in a language that all understood, the language of the pocket. Of course it is just possible that none of the improved methods will have any economic value. Even then the Demonstration Farm will have been true to its name, for it will have shown that so far western science has nothing to teach the Indian Agriculturist beyond what he has learnt from the experience of thousand generations.

But I for one have no fear that such a negative result will follow the adoption of Mr. Smeaton's scheme. It is true that labour saving machines make their appearance most rapidly when the cost of labour is high —and in Behar labour is remrkably cheap—still machinery and science must win in the long run against cheap labour and practice found only on experience. There is plenty of ignorant prejudice among the farmers of England, but every year scientific or high forming is becoming more popular. When the old order ceases to pay it must change, and give place to new. This rule must apply to India as well as to other progressive countries, and so let us not lose faith in the possibility of agricultural improvements for India, but go on trying honestly to find out the best modes of cultivation undeterred by failure, by prejudice or, worst of all, by an unreasonable terror of the possible gibes of an Ex-Lieutenant Governor.

D. B. ALLEN, C. S., M. R. A. C.

NOTES ON THE UNTRIED PRODUCTS OF INDIA.

ROXBURGH explored the vegetable kingdom of Madras and Bengal more than fifty years ago. His book on the flora of these two provinces has since formed the basis of all future works on Indian botany. The result of his labours is not only invaluable in a scientific point of view, but is also highly important for the facts ascertained by him with regard to the economic uses of the various plants. His time was, however, too early for the proper investigation of new products. In that age of tedious and difficult intercourse between the different parts of the world, when commerce had not so expanded as it has become of late years and when practical science was not sufficiently advanced to turn the commonest articles into human use, the ordinary produce of the country was more than enough to engross all the attention of that limited number of merchants then forming the mercantile public of India. Time has changed, and with it the conditions in every department of life. The telegraph, the rail, and the steam communication have united the remotest regions of the earth into one compact international organisation, such as even the different parts of a little country like England were never welded into. Science also has come to the aid of

man in increasing and cheapening his comforts by the utilisation of things formerly considered as utterly useless or even injurious to health. Improved facilities created a keen competition in trade, which has minimised the profits, narrowed the room for small capitalists and, except under especially favourable circumstances, has put a stop to that sudden accession to wealth, which formerly was of frequent occurrence in many well-conducted merchantile pursuits. In our struggle for the acquisition of riches and comfort, the most promising field in the present day lies in the inexhaustible store of raw materials now rotting in the country. The causes, that have created difficulties in the acquirement of wealth on beaten paths, suggest the feasibility of a divergence from them, and will render material helps in the discovery and introduction of new lines of trade. In the general conception of ways and means and in practical operations for the attainment of this desirable result, Government have been from the beginning ahead of the public, as it rightly should be in a country, where the people are so wedded to ancient traditions as to be incapable of realizing the change which the world has undergone since their customs, mode of manufacture, method of trade, system of cultivation, and all such things got stereotyped on native life three thousand years ago. The laudable exertions of Government in this direction have been crowned with success in the introduction or development of many important articles, such as the potato, tea, coffee, cinchona, tobacco, etc. The efforts of Government are not simply confined to direct encouragement, but continued endeavours are being made to clear every obstacle in the path of commercial progress and to disseminate useful information among persons interested in the development of the economic resources of India. Among instances of this kind might be mentioned the trials of fibre machines, the exhibitions of arts and produce, and the establishment of the Economic Department with Dr. Watt at its head. But the success achieved by Government is a national property from which no individual can claim to reap exclusive benefit The profits attending on the first discovery of a valuable new article, or even a monopoly in it, might only be earned by individual exertion. That vast regions of the economic kingdom still lie unexplored, waiting to be examined and used, there is no doubt whatever. The object of these notes will therefore be to direct the attention of persons interested in the matter to products, which are either known at present, but which might become a lucrative source of gain to any one succeeding to turn them to good account. The Editor of this Journal is prepared to furnish all available information on any article which may be selected for trial, on the understanding that the general results of the experiment are to be communicated to this paper. Fibre is a class of article for which the demand is steadily increasing, and in which there is scope for almost unlimited expansion. Fibres which have a prospect of being developed into commercial product will be therefore first considered in these Notes, and among those likely to succeed the following may be mentioned :—

Abroma augusta (Bengali—*Ulatkambal*) is one of the plants the fibre of which might be successfully introduced into the market. It is a perennial which, although now rare, might be cultivated everywhere in Bengal with very little care. Dr. Roxburgh paid special attention to it "on account of the beauty, fineness and strength of its fibre". It can be grown more easily than jute or *san*, the fibre is extracted from the unblossomed shoots by retting, and two or three cuttings can be obtained during the year from the same plants. The fibre is soft and glossy and might prove a good substitute for silk. A small sample was lately supplied by the writer of this article to an exporting firm at Calcutta, which, though inferior in quality to the ordinary produce of the plants being extracted from an old stem, gave sufficient indication of a future prospect. A trial consignment of two or three tons was at once ordered, but which could not be supplied owing to the scarcity of the plant. The root of the plant is a valuable medicine for dysmenorrhœa.

Agave Americana and *Anana sativa* are well known. These must wait till a good machine for the extraction of the fibre is invented. Agave fibre, extracted inthe ordinary native way, might pay where labour is cheap as in west Bengal and the N. W. Provinces, but the market must be kept furnished with a steady supply. The manufacture of matting from it, which must be far superior to coir-mats, seems to be the most lucrative way of utilising it. Such mats will doubtless find a market in Australia and Europe. They should be coloured and patterned with sappan wood and other indigenous dyestuffs.

Anona reticulata (Bengali—*Nona*), although an introduced plant, now grows wild in Bengal, Madras and South India,. In some places it is cultivated for its fruit, the netted custard apple. It grows to a middle-sized tree, with a height from 20 to 30 feet. The branchlets yield a rough white fibre which might be used in the manufacture of paper and rope and cordage. Endeavours should be made to reduce the size of the plant to long, slender, straight stems, like jute, for the branchlets or big trees are short and knotty and do not yield clean fibre. This can probably be effected by sowing the seeds thickly, and by taking off from the planta-

tion as many cuttings as may be ready during the year. By such means, the mulberry plant, cultivated for leaves on which silk-worm is fed, has been reduced to the required size. The quality and the quantity of the fibre will no doubt improve by this process. The fibre is extracted by steeping the stems in water like jute.

Bœhmeria nivea (Rhea) has now become well known. It can be grown in localities any where in the plains of India. Eastern Bengal is especially suitable for its cultivation. The fibre is strong, soft and glossy almost like silk, and is therefore well-suited for the manufacture of textile fabrics. The obstacle, which has hitherto proved insurmountable, in the way of Rhea becoming a marketable article is the difficulty in separating the fibre from the bark and gum adhering to it. Some years ago Government offered a reward of Rs. 50,000 for a machine capable of extracting the fibre in a marketable condition. Two competitive trials of machines were held at Saharanpur, with no satisfactory results. The offer of reward has now been withdrawn. The plant called *Ban-rhea* (Maontia Sp.) which grows wild in Assam and Tarai has a better prospect than Bœhmeria. Attention should be especially directed to this fibre.

Calotropis gigantea (Bengali—*Akanda*, Hindi—*Madar.*) A demand is just now springing up for the cotton produced by this plant. Two tons have lately been sent to England as a trial consignment, and another couple of tons will be sent shortly. The stems yield a strong white silky fibre which is however extremely difficult of extraction. It would make the fortune of any one, who might discover a cheap and easy method of extracting the fibre.

Connabis sativa (Bengali-*Siddhi*, Hindi-*Bhang.*) or hemp grows wild in many parts of Bengal and the N. W. Provinces and in the outer ranges of the Himalaya. Gunny cloth is made of the fibre in Kumaun. A trial might be given to the fibre as a paper making material, as the supply will be abundant if a demand arises.

Hibiscus Abelmoschus (Bengali—*Latakasturi.*) The plant can be cultivated any where in the plains. The seeds (musk mallow) have a fragrance like that of musk, and are sold at Calcutta at Rs. 3 per seer. They are imported into England from the West Indies and are used in the manufacture of perfumery. The stalks yield a white glossy fibre The plant might be cultivated both for seeds and fibre.

Hibiscus esculentus (Bengali—*Dhenras*, Hindi—*Bhindi.*) It is extensively cultivated in Behar and the N. W. Provinces for its fruit, which is used as a vegetable. When the fruit is over, the stalks, now used for fuel might be made to yield a rough fibre, for which there is a demand in Australia, if it can be supplied at a reasonable price. It will not pay to cultivate it for fibre only, for it has no chance of competing with jute and other ordinarily cultivated fibres. In cultivating for fibre, all broad-leaved plants should be avoided, unless they have other recommendations in their favour, *e. g.* if the fibre be especially good.

Hibiscus ficulneus (Bengali—*Ban-dhenras*). It grows wild in damp localities and is often found as weed in shady places. It is an annual, growing in the rainy season and flowering in September, when the plants should be cut down and retted for the extraction of the fibre; which is of an extremely good quality being soft, white and silky. I am told that it is abundant in the neighbourhood of Mutla. This is one of the things most likely to succeed easily.

Other species of Hibiscus, such as H. mutabilis (*Sthal-Padma*), H. rosa-sinensis (*Jaba*) H. sabdariffa (*Mesta*) and H. tiliaceus (*Bala*) also yield fibre, but their prospect is small compared with those mentioned above.

Linum usitatissimum (Bengali—*Tisi, masina*; Hindi—*Alsi*) or linseed. In this country it is cultivated for seeds only. The stalks are thrown away or burnt for fuel. Cannot the fibre be used as a paper-material? Sometime ago, Messrs. Hoare Miller and Co. of this town made an attempt to utilise it for the manufacture of rope and cordage but the project apparently failed.

Musa pardisiaca (Bengali—*Kala.*) Much has been written of late and various attempts have been made for the utilisation of the plantain fibre, but no practical results have been obtained. At Dacca, an extremely fine cloth is woven from the fibre, but the cost is fabulous, and it is made more as a curiosity than an article for use. In the Phillipine Islands, cloth made of the fibre of Musa textilis, of which the Manilla hemp is made, is worn by all classes of the people. The only purpose for which plantain fibre can be profitably employed in this country is the manufacture of paper, but the unwildy nature of the plant precludes the possibility of its being transported to a distance without raising the price to a too high rate. The following processes might be tried to get over this difficulty.—(1) The layers which sheathe the stem might be cut into slices longitudinally and dried. (2) The sheaths might be scraped with a blunt knife to rake out the pulpy matter, then washed and dried. (3) The sheaths might be passed through an iron sugar-mill now in use all over the country, then washed and dried. (4) To obtain a better quality of the fibre, the crushed sheaths might be boiled in carbonate of soda and quicklime and then washed and dried.

Sanseviera zeylanica (Bengali—*Murva*). It is common in Madras but can be easily cultivated in Bengal. It is said that the ancient Hindus made their bow strings from the fibre obtained from the stems of this plant. A good machine is wanted for the extraction of the fibre.

Sida rhombifolia (Bengali—*Swet-berela.*) This plant is a common weed in Bengal. It yields large quantities of strong, white, flaxy fibre. Some years ago the Raja of Bolihar in Rajshahi cultivated it. The produce was good, but it is not known whether any valuation was obtained for it. Fibre might be extracted from the wild plant and tried as a paper material.

The various species of Urtica (nettles) which grow wild in the hills yield good fibre, but no definite trial has yet been given to them. Many forest trees also yield fibre, but which have still to be properly tried, such as the Bauhinias, the Sterculias, etc.

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SUGAR MAKING

IN THE CHIKODI TALUKA, BELGAUM COLLECTORATE, BOMBAY.

THE sugarcane juice is pressed out and poured into a large circular boiling pan about 5 feet in diameter and 2 feet deep. It is then allowed to come to the boiling point several times; stirring of the juice and skimming off of the impurities as they rise to the surface go on at short intervals. During the boiling of the juice about a quart of water in which the bruised roots of *Bhendi* plant (Hibiscus esculentus) have been macerated for about an hour, is poured into it. This liquid is of the consistency of the white of eggs, and acts in the same way as that substance does in clarifying sugar, effectually bringing to the surface all impurities in the boiling juice. After the skimming away of the impurities, the juice becomes of a clear light brown colour. When the juice has thickened to a thin syrup it is poured into a deep wide-mouthed earthen pot, called a *ranjan*. Here it is allowed to cool, being stirred vigorously at intervals to ensure the cooling taking place uniformly throughout the syrup. And when it has cooled down to the consistency of a thick paste, it is put into small *ghagars* or narrow mouthed earthen pots.

This ends one distinct stage of the manufacture, and generally an interval of several days elapses before further operations commence.

The next step is to provide large baskets of coarse bamboo matting, which are about 5 feet square and 3 feet high. These are placed in a room, the floor of which is divided by small ridges about six inches high by six inches wide, into as many compartments as the number of baskets requires. From these compartments small narrow and shallow channels are made leading to a small pit containing a ranjan, in the floor of the room. The baskets being placed in the compartments, they are filled to within six inches of the top with the pasty sugar from the pots. This is not done direct from the pots in which the sugar may have been lying for several days, but the sugar is emptied out of the pots into a large pan, similar to the boiling pan mentioned above, and then taken from this pan by means of a large copper pot, like the ordinary Indian cooking pots, and emptied into the baskets. This pot is rinsed with a strong solution of salt every time it is filled with the sugar to be taken to the baskets. From the mass of sugar in the baskets, the treacle contained in it drains out through the basket-work interstices into the floor-compartments and flows along the channels into the pit.

To aid in the process of the surface sugar being cleared of treacle, a thick layer of green *shewal*, a weed or moss that grows in some wells and streams, is spread on the top of it. A fresh thin layer of it is added after each removal by scraping off of the surface sugar. This scraping off of the surface sugar takes place daily to a depth of about an inch, till all the sugar is emptied out of the baskets. The scrapedoff sugar is now of a darkish grey colour, and saleable in the local markets, but as it still contains a little treacle, shown by its being moist and apt to cake, it is said not to keep well. To obviate this, it undergoes a process of drying by treading and bleaching in the sun. This is done by the sugar being spread out on coarse cotton sheets, on ground prepared hard and smooth, and exposed to the sun. The sugar is spread out in a layer about 6 inches deep and then trodden on by men walking three or four times up and down over it in short steps with a twisting or grinding motion of of the feet. The trituration by treading that the sugar thus gets, breaks up the lumps in it and helps to thoroughly expose every particle of it to the sun; this dries and bleaches the sugar to a light grey colour. After this last process of treading, drying and bleaching, the sugar is not liable to cake, and is considered perfect, as it will keep any length of time.

The treacle that drains out of the sugar is stored away till it gets sale to country liquor makers.

Every detail given in the above description of sugar making was seen in actual practice by me, and I believe no essential particular escaped my notice. The method from commencemnt to end is simple in the extreme; the appliances used rough, ready and therefore cheap, but the result is not satisfactory, in as much as the production has in it worse impurities than had been got rid of by skimming at the syrup stage of the process, gathered during the subsequent stages, from filthy surroundings and unclean manipulation. The question is, can we teach the men who follow this industry a better method, giving better results, but at the same time not far removed in simplicity and cheapness to the one they are acquainted with?

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PAPER MAKING.

A JAIL INDUSTRY IN THE OLDEN TIME.

AMONG the many interesting papers rescued from oblivion and published in the form of Selections from the Records of Government, N. W. P., probably Dr. Stiven's "Notes" on paper-making in the Moradabad jail describing the various processes as there carried out a half century back, is that which best deserves attention at the present epoch, when private enterprise has been excited under Government encouragement towards the subject of Indian paper-manufacture. Dr. Stiven asserts that, "perhaps, there is not a country on the surface of the globe that is more adapted from the nature and variety of its indigenous as well as cultivated plants to supply an almost infinite quantity of raw materials for the manufacture of textile fabrics of great diversity and commercial value, and from the refuse of which alone we have means which might be made useful in manufacturing paper. Besides these, there are innumerable fibres which from their coarseness and shortness of staple are unsuited for weaving purposes etc., but still eminently useful for paper making." This has been confirmed by subsequent inquiry and information which prove, beyond doubt, that India abounds with fibre producing plants of all descriptions; few countries perhaps in the world being richer in that respect. Notwithstanding this abundant and never failing supply of cheap and excellent materials for paper-making of all kind, the sad fact remains that the indigenous industry is now, as ever, in a very backward condition and but little has as yet been done to improve it. What, however, seems still more extraordinary is the fact that, in a cotton-growing country where the inhabitants universally wear cotton clothing, this almost unlimited means of supply of one of the best articles (*viz.*, cotton rags) for the manufacture of paper should have been taken so little advantage of by the numberless petty native paper-mills scattered throughout the country. It is not to be wondered at that, with such large quantities of first rate raw material procurable and an unlimited supply of prison labor available, the attention of Government was turned in outlying districts to manufacturing paper locally for its own use. It was considered a very profitable mode of employing prisoners, affording an opportunity of giving very hard work to great offenders. The views entertained in Dr. Stiven's time relative to jail competition with private enterprise will bear reproduction in his own words :—He says, "I have heard it objected to as being unfair, the employment of prisoners in making paper in jail, as it interfered with the regular trade of the free labourer. It certainly to some extent does, but it also stimulates him to make a better article and this result has actually taken place in this city (Moradabad) since the paper manufactory was set agoing in the jail. For my part, I consider that it is a quite legitimate way of employing convcts, as the paper made is not sold in the bazar but supplied to the public Courts. He adds, "There is also another great object to be kept in view, and that is the improvement of manufacture and the judicious application of the means that superior intelligence and scientific knowledge have afforded us for developing the resources of the country, and by the use of improved machinery to stimulate the paper manufacturer to go and do likewise." These views, true and trite, were ennunciated, it will be remembered, long prior to the Sepoy War and before the advent of Railways, when Universities and the present educational system were undreamt of, with little possibility of vast developments of the past quarter of a century. The advance in this department of industry has kept pace with the general progress of the country, and the attention of individuals, not of Government, has been called into action in this advancement. There are now no less than seven steam-power paper-mills in various parts of India with others in contemplation, the products of which are fast superseding those of the native paper works far and near the primitive processes of these latter, and their consequent coarse products, being unable to compete with the

out-turn of skill and science combined in the modern art. The native papers are all hand-made and the clumsy, tedious, and expensive proceeding adopted in their manufacture, with other drawbacks, precludes competition with European appliances which have been characterised as the most perfect machinery in the whole range of the industrial arts. But the native apparatus and manipulation regarding paper-making of the present day are a decided improvement on those of the past and as native made paper is still extensively used by natives, particularly the mercantile classes, Dr. Stiven's description of the Indian mode of making hand-made paper in a by-gone period will be interesting for purposes of comparison with the same process as followed now in the country and elsewhere. To the uninitiated it may tend to give an idea of the primitive nature of Indian paper-making machinery, and the order in which the process was and is carried on and accomplished.

The materials employed are coarse canvas made from *phoolsun* and *patsun*, inferior kinds of flax, and called "tat"; occasionally, hempen bags (jangle) and old ropes of the same material; and waste Hindustani paper known as "ruddee." European waste paper, when written or printed upon, is inadmissible owing to the difficulty in extracting the ink stains, which does not obtain with Indian inks. The "tat" costs about a rupee a maund; while the price of "ruddee" is as high as five rupees for the same weight. The other articles are procurable at intermediate rates. "Ruddee" is from its high cost, only sparingly used, except in the manufacture of high-priced papers, to which it imparts a better color and smoother consistence, though the strength of the paper is somewhat limited. These materials are now used in Moradabad and other parts of the N. W. Provinces by the native paper-makers, who do not use cotton apparently from the difficulty involved in reducing them to fine pulp with their defective machinery.

This "stock" is chopped into fragments, and thrown into a masonry cistern or tank, where it is pounded in contact with water, after the same manner as soorkhee, by means of a balance lever pestle. The first stage of the operation for 10 maunds of "tat" occupies three successive days, when the stuff is washed, and dried in the sun for three or four days. It is now returned to the tank where it is intermixed, in water, with 100 lbs. of "sujjee," a very impure carbonate of soda, and 50 lbs. of slaked lime. After a second beating, continued for 8 days, the stuff is washed and dried in the sun as before; the same operation is repeated over again. Finally the stuff is returned to the tank with only half the previous proportions of "sujjee" and lime, when, after three or four day's more beating, the pulping is pronounced complete. It will be thus seen that the operation for reducing the "stock" to pulp requires time and labour and is as troublesome as it is expensive. Native patience and perseverance, however, shows very favourably in the unpretentious process we have just described.

Washing the pulp is performed as follows;—"It is put into earthen vessels or nads, at a river side if possible, and trodden with the feet, adding from time to time fresh-water; then thrown into a sheet tied at the ends round the waists of two men; they take this into the middle of the stream and allow the running water to pass through the sheet (not over it) shaking at the same time the pulp to and fro." This constitutes the process of cleansing in Dr. Stiven's own words.

The pulp is now considered ready for paper-making and is distributed into vats, measuring 4 feet every way,—four vats being considered the proper complement for one beating machine—and brought to a proper consistency by the admixture of water and stirring. When this is effected, the manipulator takes a barred frame of wood, upon which he puts a screen or cheeck made of fine grass, fixing two pieces of wood at the sides to regulate the breadth of the paper, its length being determined by the breadth of the cheeck; the general size is 22 inches long by 19 broad. "He takes hold of the frame etc., in both hands, and after passing it frequently across the water to bring up some of the pulp, he dips it vertically into the vat, and then brings it into a horizontal position on a level with the water. He moves the frame gently to and fro, so as to spread the pulp equally, raises it, and again dips it into the pulp, repeating the same process as at first" He then raises it and allows it to rest on end on a horizontal bamboo resting on two vertical ones, so as to form an inclined plane, the opposite end, of the frame being placed on the side of the vat, into which the superabundant water drains. After removing the two small pieces of wood from the screen, he turns down the top of it a little so as to facilitate the separation of the sheet, which, when removed, is laid down flat on a space at his side. "In this way he goes on laying one sheet on the top of the other without any intermediate cloth or substance of any kind, until he has got 10 quires made, or a "guddee" consisting of 240 sheets, which generally takes him a whole day to accomplish. When we compare this rate of out-turn with that effected by the "Four drinier" machine, the difference is appalling. The whole process by the latter, yielding finished paper, is performed at the rate of from 100 to 200 feet of paper, of any width

ranging up to 72 inches, per minute, under ordinary circumstances.

The "guddee" or heap of freshly made paper is pressed between boards under weights for 24 hours before the paper is dried. Drying is accomplished by separately plastering each sheet upon a wall which has been made smooth for the purpose. This would restrict the manufacture to fine weather. When dry, the surface which was in contact with the wall gets tolerably smooth; the other is still rough, which roughness when very conspicuous is got rid of by rubbing down with pieces of burnt brick. The paper is now ready for sizing. The size is made of wheaten starch, which is applied with a kind of map made of rolls of coarse flannel or or blanket dipped into the starch and passed over the paper, which is afterwards hung up on lines to dry.

The last operation is polishing, which is effected by means equally simple and tedious. A sheet of paper is laid on the curved side of a block of wood, and an oily cloth very gently passed over it. The surface of the paper is then polished with a piece of common jasper or blood-stone, which the workman passes rapidly up and down the paper with great force until a gloss appears on the surface; turning the sheet he repeats the same process. An expert it is said can polish half a "guddee" or 120 sheets per diem. The paper is now sorted, cut, folded, and made up into quires and "guddees." The outturn from 10 maunds of raw material is found to be 60 "guddees" or 30 English reams, which is a very unsatisfactory result, particularly when *time* is taken into account. The most expensive items in the detail of cost are "Pounding," "Paper-making," and "Polishing," which together absorb nearly a half of the total cost Rs. 68, in equal parts of a little over Rs. 11 each. The "raw material" (tat) costs Rs. 10, while "sujjee" lime, size and other ingredients cost collectively about the same. The remaining items call for no remark.

The paper when ready for the market weighs 4¼ seers per "guddee," from which ¾ seer has to be deducted for *size*, thus leaving 3½ seers as the the actual weight per "guddee." This makes a loss of 4¾ maunds during the operations commenced with 10 maunds of raw meterial. This is not a very unfavorable proportion if the long period the operations involved be not considered depreciatively. No better proportions are obtained with the labor and time-saving appliances of the present day.

The whole produce of 60 "guddees" would realise about Rs 98 which leaves a balance of Rs 30 as clear profit on the side "manufacture," exclusive of "wear and tear" of plant. But this profit of 8 annas per "guddee" of paper sold is only for the working season, whereas very little can be done during the rains, for reasons already assigned when describing the process of drying.

Having given the most favorable view of indigenous industry conducted under European supervision many years ago, we leave our readers to decide whether the unpretentious methods described are worth preserving in the country, or whether it is within the range of possibility to so improve them as to still hold a place in the competition of the "times."

PAT. DOYLE, C. E., F. G. S., LOND.,
M. A. Inst. M. E.

AGRICULTURAL IMPLEMENTS.

II

STEAM PLOUGH.

It is a fortunate thing that people in all other parts of the world do not like those of Indian rest satisfied with only that which has been handed down to them by their forefathers. Had that been the case we should have seen the European farmer of the present day cultivating his fields with implements quite as rude, as unscientific and as uneconomical as the primitive plough of this country. Neither should we ever have seen modern improved ploughs of different designs and constructions to suit varying conditions under which they are to be applied and to do from 3 to 4 times as much work with the same amount of power as the time-honored plough of our Indian peasant.

The principal defects of the latter and some of of the improvements gradually introduced into the former have been briefly mentioned in these columns sometime ago. It is proposed in the present article to state the considerations which led to the introduction of steam power to the cultivation of soil, the conditions under which it can advantageously replace animal power and some of the principal systems of working the steam plough.

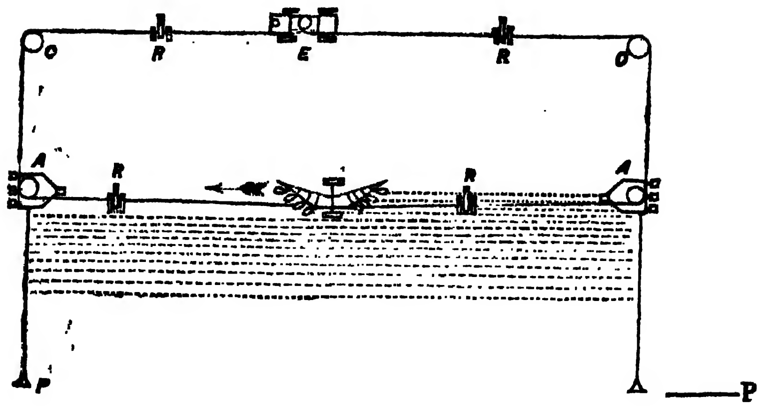
In ploughing by animal power, a considerable portion of the power is taken up in lifting their own weight up and down all the inequalities of the ground, consequently a very small portion of the power is left to be usefully exerted on the implement. The utmost available force which can be brought to bear on the implement in case of English agricultural horses (which I might here mention are much bigger and more powerful animals than those

generally met with even in first class cities of this country) is not more than 3 cwt. per team, and, if my observation was correct, not more than a couple of hundred-weights per pair of Indian buffaloes, which are known to be better draught animals than bullocks; at the same time resistance of the soil to the implement is greatly increased by being so closely trodden by the draught animals, "for if a horse (or a bullock or any other draught animal) be taken when the land is in a rather plastic state, and walked across the track of a steam plough and made to travel to and fro transversely on every 10 inches width until a breadth of 6 yards are trodden over, it is then found that if the steam cultivator has just sufficient steam to perform its work properly before it arrives at the ground thus trodden down, it will be completely stopped before it gets through the 6 yards; considering the momentum of the fly-wheel, this experiment shows plainly that the power required is something very material, and experiance shows that one third additional draught is required on the land that has been trodden to the same extent as in the cultivation by horse- (or cattle) power. It is clear therefore that a considerable part of the draught of the horses (or cattle) is expended in undoing the compression caused by their own weight." Very different is the case when steam-power is employed; the engine from which the power is derived remains stationary, only the cultivating implement, be it a plough or a cultivator, moves to and fro on the ground, and a draught of as much as 35 cwt. is available on the implement. Even with improved multiple ploughs turning three or four furrows and drawn by 4 to 6 horses, not more than 2 feet and 6 inches of ground is acted upon in one operation and this with rather some difficulty, the utmost draught on the implement being 9 cwt., and the joint weight of the animals 6 tons; whereas with steam, the draught on the implement is 35 cwt., the width of the ground acted upon in one operation 4 feet, whilst the weight of the implement which alone is to be moved to and fro across the field is only a ton and quarter.

Then again the steam-plough is drawn across the field at an average speed of 2½ miles an hour, whereas the horses travel with the plough at the rate of about a mile and half an hour and cattle still less; this difference in speed makes a great deal of difference in the condition in which the soil is left by them respectively. By the rapid motion of the former, slices are thrown quite 2 feet apart from their original position in a much broken and loosened state, thereby exposing a large amount of surface to the action of sun and atmosphere. To practical farmers who know the cost and difficulty to pulverise large unbroken furrows, the condition of the soil as stated above, is greatly desirable, as it very much reduces the cost of after-operations, sun and atmosphere doing a large portion of the work. Nor are these the only advantages of the steam-plough over that drawn by animal-power. Soil is in the best condition for ploughing during certain parts of the year only, which in this country will come hardly more than 3 months in a year. A farmer who has 1800 acres under cultivation—not unusually big for a farm in Europe or America—should have under his command animal power sufficient to cultivate at the rate of 600 acres a month or 20 acres a day; this will necessitate his keeping in this country a herd of about 200 bullocks all round the year, whether he has any work for them during the rest of the year or not. Taking a very moderate rate of Rs. 2 a head per month for their fodder, it comes to Rs. 4800 a year, not to speak of the time and trouble required to look after 200 heads of cattle. This is indeed a serious drawback to big farming in this country. By the introduction of steam-power in cultivation, the case is materially altered; one set of steam cultivating machine, cultivating from 40 to 50 acres of land a day will not only be sufficient to cultivate 1800 acres within the required time but the engines will also be available for supplying power to other agricultural operations, such as irrigation, reaping, thrashing, corn-grinding etc. etc. Even if the farmer has no other work to keep his engines going after the cultivation is over, all that he will have to lose is 9 months' interest on the capital he had invested in buying the set, which is a trifling amount in comparison with the cost of keeping 200 heads of cattle.

The first idea which naturally occurs in the application of steam power to cultivation is, that of attaching the implement immediately behind the engine like what is done in cases of horses or bullocks, and to move the engine to and fro over the land; but it does not take long to see the impracticability of such method. Apart from the power absorbed for the locomotion of the engine itself on heavy cultivated soil, the compression caused by such an enormous weight travelling over the cultivated ground would completely nullify the effect produced by the implement. The plan which next suggests itself is to keep the engine stationary, and convey the motive power to the implement by means of wire-rope; the use of wire-rope met at first with some difficulty, which however

FIG. I.

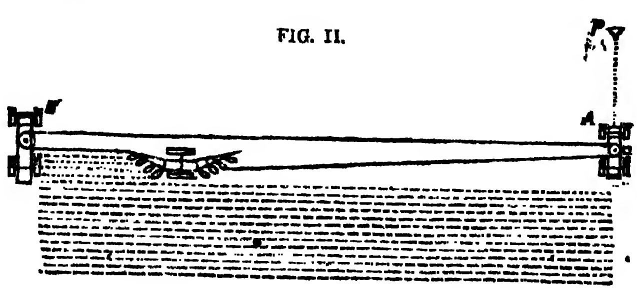


was gradually overcome. Figure I shows the system of working first adopted. Engine E is placed at one side of the field to be cultivated, C, C are the two corner pullies round which the rope passes, A, A are the two movable anchors; R, R, R, R rope-porters or pullies for supporting the rope; P, P are two fixed points to which are connected the movable anchors by ropes to counteract the pull of the wire-rope in the opposite direction. " Movable anchor consists of a wrought-iron carriage with a horizontal wheel mounted on it, round which the hauling rope of the plough works, whilst six sharp-edged wheels on which the anchor carriage is mounted enter the ground and resist the side pull of the rope." The engine has attached to it underneath the boiler, two winding drums, round which about 12 to 1600 yards of wire-rope are so coiled that whilst one would take in the rope the other would pay out and *vice-versa.* Each time the implement comes to the headland, the movable anchors are shifted a little forwards so as to load the implement in a fresh line; reverse motion is then given to the rope causing the implement to move in the opposite direction. In early days of steam ploughing the anchor had to be moved by hand each time, and so also the rope porters, which necessitated the employment of good many hands. This together with considerations such as complications of the parts, the frequent bending of the rope over pullies of small diameter causing much loss of power, wear and tear of the rope itself and great loss of time required in fixing the apparatus, soon led to the abandonment of this method of supplying power to the implement.

The second mode of using the wire-rope was a mere modification of the first and consisted in placing the engine in one corner of the field, leading the rope one way along the side of the field and the other way diagonally round the two movable anchors placed in the same position as in Figure I. By this triangular plan about one fourth of the rope with requisite number of porters was saved. It was a great improvement on the former, and it showed to a great extent that more direct the pull the less the loss of power and wear and tear of the rope.

The third method of working with wire-rope as shown in figure II consisted in placing the engine E on

FIG. II.

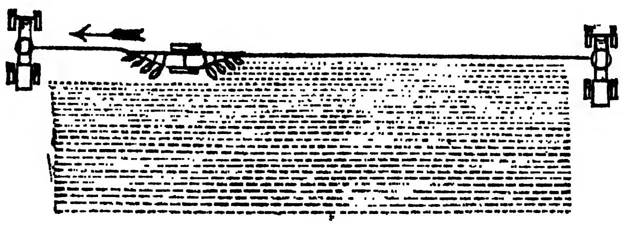


one side of the field and a movable anchor A at the opposite side. P is the fixel point connected as before with the anchor by a rope which drew it slowly along the head-land. The rope stretched from one of the winding drums of the engine across the field to the movable anchor placed at the opposite headland and then back again to the implement to which it was attached. Another rope stretched from the second drum of the engine to the implement. The work was performed by the engine winding the rope by one drum and paying it out from the other, causing the implement to be pulled backwards and

forwards across the field; the engine and the anchor both moving alternately along the opposite head-lands, keeping always in line with the work. In this system there was direct pull in one direction and further saving of the rope and one movable anchor. In this also some difficulties were met with, but it is not necessary to mention them here as they will not interest the general reader of the Indian Agricultural Gazzette, though they might be interesting and useful to persons following the profession of a civil or mechanical engineer; so also the steps which were taken to get over these difficulties before the introduction of the modern double-engine system will not much interest the general reader, being more of engineering interest than agricultural.

Passing over various stages of improvements and developments in steam-ploughing, we come to the most recent and improved system of steam-cultivation with the double-engine system. It consists of two self-moving engines placed on opposite head-lands as shown in figure III. These engines have one

FIG. III.



winding drum each instead of two, as was the cause with engines of the previous systems, "each alternately drawing the implement towards itself, and the engine not in work paying out the rope. The great advantage of this system over all others "is the facility with which the machine is set to work and taken up. The engines are ready to start into a fresh field the moment they stop work, and remove themselves and whole of the tackle without any additional manual and animal labor. If two neighbouring farmers buy this set, it will cultivate both farms and when not employed for cultivation, each farmer will have one engine to do his thrashing, chaff-cutting and other farm-work."

With a set as described above, 30 to 50 acres of land can be ploughed in a day, and the following figures will give a good idea of the cost of working such a tackle per day of 9 hours.

Interest on the capital ...	Rs 13	As. 5	P. 4
Sinking fund	„ 6	„ 10	„ 8
Fuel	„ 12	„ 8	„ 0
Wages	„ 3	„ 0	„ 0
Oil and Grease	„ 1	„ 0	„ 0
Miscellaneous	„ 0	„ 8	„ 0
Total	Rs 37	As. 0	P. 0

I have calculated the interest on supposition that the engines would have no more work than three months in the year, which is however an extreme case; if on the other hand the engines are kept employed all the year round in some sort of useful work, the interest on the capital should be reduced by one fourth, which will bring the total to very near Rs 27. Taking the work even at the lowest, that is 30 acres a day, the cost for ploughing an acre of ground 9 inches deep comes to Rs. 1-3-9, when the engines remain idle for 9 months in the year, and to 14 annas and 5 pies when the engines are kept at work all the year round. In Bengal it costs from Rs. 3 to 4 an acre to bring the soil in a fit condition to receive seeds, but with steam-plough, if the ground had been ploughed up in proper time, it will hardly cost more than another rupee to bring it to the proper condition to receive seeds. So even when considered financially, steam-plough has immense advantage over the plough driven by animal power.

It must also be understood that steam-plough can not be employed every where with advantage, for instance, in a small field lying in an out-of-the-way place or in a locality where coal or any other suitable kind of fuel is expensive and not easily available. Fields intended to be ploughed with steam-power must be cleared of all trees, old stumps of trees or any other obstacle which may impede the course of the implement; all ditches and canals must be filled up and the ground made pretty nearly level.

B. PALCHAUDHURI, M. I. & S. I.

NEWS.

MR. J. CAMPBELL-OMAN, Meteorological Reporter to the Government of the Punjab, has published a very full report on the weather in that province for the year 1884-85. To this are added tables showing the rainfall, temperature, and prevailing winds throughout the year 1884. The chief feature in the weather appears to have been the retarded and interrupted character of the summer

monsoon rains, the result, as suggested by Mr. Blanford, of the unusually heavy snowfall on the inner ranges of the North-West Himalayas during the winter of 1883-84. The rainfall in the Punjab, although interrupted, was abundant.

THE latest reports from Cachar and Sylhet state that the weather had been satisfactory, whilst good rain had fallen in Assam. There has been very heavy rain in Darjeeling, the Terai, and the Duars within the last few days, and the quality of the tea manufacture may, for a short time, be unfavorably affected thereby.

THE returns of the rail-borne trade of the Bombay Presidency for the quarter ending 31st March show that, as compared with the corresponding period of the previous year, there was remarkable improvement in the traffic. The number of vessels which obtained their clearance to foreign countries during the quarter under review amounted to 151 as against 80 in that preceding, and 104 in the corresponding quarter of the last year. The cargo carried by these vessels has also increased to a considerable extent. A comparison of the figures for the quarter under review with the previous quarter, and also with the corresponding quarter of the last year, respectively, shows an increase of 4,255,749 maunds or 29·9 per cent., and of 2,601,764 maunds, or 16·4 per cent.

COLONEL Stanton's report, on the Railways of India, contains an interesting description of the results obtained so far on the experimental petroleum-boring at Khatun under the Biluchistan Agency. Boring was commenced in February last; and after some considerable boring and working difficulties had been overcome, two veins of oil were struck at 28 feet and 36 feet depth respectively. On the 6th March drilling was stopped and the oil tested. A pump was improvised, and during the hour or so that pumping was continued, the thick oil came out in a stream of over 6 inches in diameter. Next day pumping was continued for 7½ hours, with the result that about 2,000 gallons of oil was collected, and there was no appearance of the oil going out. Pumping then ceased, as it was useless to raise more oil, until storage was obtained. The oil obtained is now being used in the boiler furnace with very satisfactory results, and it is proposed to adapt some of the engines of the Sindh-Pishin Line for experiments with the oil as fuel.

THE product of the Government cinchona plantations in Java in the year 1884 was 400,286 half kilogrammes, of which 394,663 half kilos. were sent for sale to the Netherlands, and the remainder kept for use by the local Military Medical Service. The sale prices realised for part of the stock at Amsterdam were very low, being only 64 centimes per half kilo. This is said to be partly due to the general inferior quality of the crop; but as the bark of the young branches and twigs is no longer gathered, it is expected that there will be a rise in prices. As is the case in the Darjeeling plantations, the old inferior sorts of plants are being gradually rooted out and replaced dy those species which produce a bark of greater industrial value.

THE quantity of tea exported from China and Japan to Great Britain from the commencement of the present season to the 18th of June was 36,115,981 lbs., as compared with 35,931,166 lbs. during the corresponding period of the last year. The exports to the United States and Canda during the same period were 1,645,574 lbs., against 2,808,797 lbs.

MESSRS. J. THOMAS & CO.'S Price Current states:—Our reports from Bengal are not so favorable as they were a fortninght ago. The season is a late one, and the plant in most Concerns is very small, and has suffered much from the heavy rain they have lately had, and sunshine is much wanted. The sudden rise of the Ganges also caused several chur factories to cut unripe plant for fear of inundation. Manufacture has commenced at most of the factories and the returns of vat-produce are fair. Complaints have also come to hand of too much rain in Tirhoot and Chumparun, but in Chuprah a little more would be acceptable. Manufacture in these districts will not be general until about the 14th instant, but, from the returns we have so far received, vat-produce has been fair. Good rain has fallen in the North-West and there prospects have materially improved, and the outturn will be larger than we anticipated a short time ago. Messrs. William Moran & Co.'s Reports from Behar state that very heavy rain has fallen during the past fortnight. In Tirhoot and Champarun, this has submerged some of the low lying plant, which otherwise would not have been cut for some time, and the yield from which can not be satisfactory Mahai has commenced pretty generally, but we have not received sufficient returns to enable us to form an idea of what the results have been so far. A spell of fine wheather would improve prospects generally. In Chuprah manufacture will not be general before about the 20th instant, but the late rain has done good, and given planters sufficient water for manufacturing purposes. There is not much of interest to report from Lower Bengal. Most districts are at work, but in several Zillahs pressure from the rivers has necessitated the cutting of unripe plant. From the North-West, we hear that the weather has been favourable.

THOUGH the tea season in Ceylon generally has been a late one, the splendid flushing weather of the latter part of April and all last month has fully made up for former deficiency, and the *Times of Ceylon* does not anticipate any falling off in its estimate of 3,500,000lbs. Shipments during this and next month will undoubtedly be on a very large scale, and the figures for export will go up " by leaps and bounds." "We feel sure our coffee crop will also be up to our estimate. The outlook in some respects is most reassuring." A Ceylon paper remarks that the tea planters there, are making a decided advance in the style of their packages. Not only is the introduction of Japan-made boxes of excellent and neat manufacture a great improvement on the past, but many local firms are turning out tea-chests which are in marked contrast to the heavy, cumbrous, and unsightly packages despatched from Calcutta.

THE Madras School of arts is at present very busy executing a most elaborately carved door-frame for the London Exhibition of 1886. The design is purely eastern, and represents Hindu mythological figures from the pencil of Mr. Havell, the Superintendent, who has cancelled the three months' privilege leave he had just obtained, in order that he might personally supervise the execution of this exhibit, which is to cost about Rs 300.

DURING the past month 179,057 bales of cotton, valued at Rs 1,74,91,881, were shipped from Bombay. During the same period 250,857 cwts. of wheat, valued at Rs 10,17,564, were shipped from ports in Sindh.

CATTLE DISEASE still continues very bad in the Bangalor district, as during the month of May 4,325 heads of cattle died, which added to the deaths in the previous month, gives a total of upwards of 7,000 deaths. The ryots find some difficulty in procuring cattle for their work, and the price has nearly doubled.

THE Italian Barque Zeo Batista, which arrived in Madras-roads from Moulmein on the 24th June, brought about 1,200 tons of teak timber for the local market.

THE cattle destroyed by tigers and cheetahs during the quarter ending 31st March 1885, in the Madras Presidency, were :- Bullocks 608, cows 758, calves 241, buffaloes 199, sheep 154, goats 173, horses or ponies 19, asses 16, dogs 41, pigs 13.

GOVERNMENT have sanctioned a sum of Rs 1,54,000 for survey and settlement operations in Sindh for the current official year.

THE returns of this year's American wheat crop are sufficiently forward to justify a confident forecast of the result throughout the United States. The deficiency is likely to equal 20,000,000 quarters, a quantity about double the annual crop of Great Britain. This should mean that Indian and Russian wheats will come to the front again, and an early revival of the trade in this country may be safely looked for. The exports from these countries so far, compare favourably with those of last year, and the market has already felt the influence of English demand. During the few days from the 27th of June to the 6th instant, the wheat export from Karachi amounted to 118,575 bags.

THE Bengal Government estimated the stocks of rice in and around Calcutta for the first week in July at 20,64,058 maunds, of which 10 lacs are available for export.

THE hottest day in June last, in Calcutta, was the 2nd, when the thermometer rose to 103·3°, and the coolest was on the 16th, when it fell to 76·2°. Rain fell on eighteen days during the month, the average number for the last 24 years being nineteen days. The total fall of rain was 11·40 inches, the average for the last 48 years being 12·08 inches. There were 172·4 hours of bright sunshine out of a possible number of 402·4.

THERE is an abundance of rain in Coorg. The coffee crop promises to be a heavy one and to ripen early.

THE number of deaths registered in the Panjab during the month of May last was 40,260, as compared with 31,247 in the previous month. The increase was principally due to fevers and bowel complaints.

It appears from a report by Col. J. Le Mesurier, R.E., Chief Engineer for Irrigation, that during the year 1884-85, the total area of land irrigated in the Bombay Presidency was 37,703 acres as compared with 32,864 acres in 1883-84, and 28,736 acres in 1882-83. The increase of total area as compared with that in 1882-83, was 8,967 acres and in 1883-84 4,839 acres. Although there was some decrease in the *kharif* area on some of the works, there was a considerable increase in the *rabi* irrigation on most of the works—a result which on the whole is considered satisfactory. The increase in the *Ekruk* tank is noticeable among the older works, but the greater part of the increase is due to the *Gokak* canal and the other two works which were brought into operation during the year under review. The rainfall of the year at almost all the stations was on an average less than that of last year, which was an exceptional one in this respect and cannot, therefore, be taken fairly for comparison. Generally it may be said that the rainfall was of average amount, though somewhat short in the northern part of the Presidency during the *rabi* season.

EXTRACT.

Some Points in the Composition of Soils,

BY

LAWES AND GILBERT.

1. The annual yield of nitrogen per acre in various crops, grown for many years in succession on the same land without nitrogeous manure, was found to be very much greater than the amount of combined nitrogen annually coming down in rain and the minor measurable aqueous deposits.

2. So far as the evidence at command enables us to judge, other supplies of combined nitrogen from the atmosphere, either to the soil or to the plant itself, are quite inadequate to make up the deficiency.

3. The experimental evidence as to whether plants assimilate the free nitrogen of the atmosphere is very conflicting; but the balance is decidedly against the supposition that they so derive any portion of their nitrogen.

4. When crops are grown year after year on the same land, for many years in succession without nitrogenous manure, both the amount of produce per acre, and the amount of nitrogen in it, decline in a very marked decree. This is the case even when a full mineral manure is applied; and it is the case not only with cereals and with root-crops, but also with *Leguminosæ*.

5. Determinations of nitrogen in the soils show that, coincidently with the decline in the annual yield of nitrogen per acre of these very various descriptions of plant, grown without nitrogenous manure, there is also a decline in the stock of nitrogen in the soil. Thus a soil-source, of at any rate some, of the nitrogen of the crops is indicated. Other evidence pointed in the same direction.

6. Determination of the nitrogen as nitric acid, in soils of known history as to manuring and cropping, and to a considerable depth, showed that the amount of nitrogen in the soil in that form was much less after the growth of a crop than under corresponding conditions without a crop. This was the case not only with gramineous but with leguminous crops. It was hence concluded that nitrogen had been taken up as nitric acid by the growing crops.

7. In the case of gramineous crop-soils, the evidence pointed to the conclusion that most, if not the whole, of the crops was taken up as nitric acid from the soil.

8. In the experiments with leguminous crops it was clear that some at any rate of the nitrogen had been taken up as nitric acid. In some cases, the evidence was in favour of the supposition that the whole of the nitrogen had been so taken up. In others this seemed doubtful.

9. Although in the growth of leguminous crops year after year on the same land without nitrogenous manure, the crop, the yield of nitrogen in it, and the total nitrogen in the surface soil, greatly decline, yet, on the substitution of another plant of the same family, with different root-habit and root-range, large crops, containing large amounts of nitrogen, may be grown. Further in the case of the occasional growth of a leguminous crop, red clover for example, after a number of cereal and other crops, manured in the ordinary way, not only may there be a very large amount of nitrogen in the crop, presumably derived from the subsoil, but the surface soil becomes determinably richer in nitrogen, due to crop-residue.

10. It was found that, under otherwise parallel conditions, there was very much more nitrogen as nitric acid, in soils and subsoils down to a depth of 108 inches, where leguminous than where gramineous crops had grown. The results pointed to the conclusion that, under the influence of leguminous growth and crop-residue, the conditions were more favourable for the development of the nitrifying organisms, and especially in the case of deep-rooting plants, of their distribution, thus favouring nitrification of the nitrogen of the subsoil, which so becomes a source of the nitrogen of such crops.

11. An alternative was that the plants might take up at any rate part of their nitrogen from the soil and subsoil as organic nitrogen. Direct experimental evidence leads to the conclusion that fungi take up both organic nitrogen and organic carbon, but there is at present no direct experimental evidence in favour of the view that green-leaved plants take up either nitrogen or carbon in that form from the soil; whilst there are physiological considerations which seem to militate against such a view.

12. In the case of plots where *Trifolium repens* and *Vicia sativa* had been sown, each for several years in succession, on soil to which no nitrogenous manure had been applied for about 30 years and the surface soil had become very poor in nitrogen, both the soil and subsoil contained much less nitrogen as nitric acid where good crops of *Vicia sativa* had grown, than where the more shallow-rooted *Trifolium repens* had failed to grow: and the deficiency of nitric nitrogen in the soils and subsoils of the *Vicia sativa* plots, compared with the amount in those of the *Trifolium repens* plot, was, to the depth examined, sufficient to amount for a large proportion of the nitrogen of the *Vicia* crops.

13. It may be considered established, that much, if not the whole, of the nitrogen of crops derived from nitrogen within the soil—accumulated or supplied; and that much, and in some cases the whole, of the nitrogen so derived, is taken up as nitrates.

14. An examination of a number of United States and Canadian prairie soils showed them to be very much richer in both nitrogen and carbon, to a considerable depth, than the surface soil of old arable lands in Great Britain, and about as rich, to a much greater depth, as the surface soil of permanent pasture land.

15. On exposure of portions of some of these rich prairie soils under suitable conditions of temperature and moisture for specified periods, it was found that their nitrogen was readily susceptible of nitrification, and so of becoming easily available to vegetation.

16. After several extractions, the subsoils almost ceased to give up nitric acid; but on seeding them with a tenth of a gram of rich garden soil containing nitrifying organisms, there was a marked in-

crease in the rate of nitrification. This result afforded confirmation of the view that the nitrogen of subsoils is subject to nitrification, if under suitable conditions, and that the growth of deep-rooted plants may favor nitrifications in the lower layers.

17. Under favorable conditions of season and of cultivation, the rich prairie soils yield large crops but, under the existing conditions of early settlement they do not, on the average, yield crops at all commensurate with their richness, when compared with the soils of Great Britain which have been under arable culture for centuries. But so long as the land is cheap, and labour dear, some sacrifice of fertility is unavoidable in the process of bringing these rich virgin soils under profitable cultivation.

18. A comparison of the percentages of nitrogen and carbon in various soils of known history, showed that a characteristic of a rich virgin soil, or of a permanent pasture surface soil, was a relatively high percentage of nitrogen and carbon. On the other hand, soils which have long been under arable culture, are much poorer in these respects; whilst arable soils under conditions of known agricultural exhaustion, show a very low percentage of nitrogen and carbon, and a low proportion of carbon to nitrogen.

19. Not only the facts adduced in this and in former papers, but the history of agriculture throughout the world, so far as it is known, clearly show that, pre-eminently so far as the nitrogen is concerned, a fertile soil is one which has accumulated within it the residue of ages of natural vegetation, and that it becomes infertile as this residue is exhausted.—*Journal of the Chemical Society of England, for June* 1885.

Alimentary Value of the Different Parts of the Wheat Grain.

Although the envelope of the wheat grain (14·36 per cent. the weight of the whole) is rich in nitrogenous substances (containing 18·75 per cent.), yet these substances are shown by direct experiments of the author's (A. Girard) to be incapable of assimilation by the human alimentary system, which particularly leaves the envelope unaltered. Further, amongst these nitrogenous substances is included the ferment discovered by Mege Mourios, and named by him *cerealin*. This substance acts on starch in a manner nearly like that of diastase, and during the fermentation in the process of bread-making, it modifies the gluten of the flour, removing its plasticity, and imparting to it the brown colour which in bread prepared from "entire flour" is commonly but erroneously attributed to the bran diffused through the mass. In these and other ways it therefore deteriorates the quality of bread. There are assimilable mineral substances contained in the bran to the extent of 0·4 per cent. of the whole grain, while the purely farinaceous internal parts contain 0·6 per cent. of such mineral substances; but considering the variety of materials now used for food, the gain in this respect must be regarded as unimportant, and as not compensating for the inconveniences attending the presence of the envelope in the flour. Again, although the embryo or germ contained in the wheat grain is rich in nitrogenous substances, and these probably assimilable, it also should be eliminated from the flour, because it contains not only *cerealin*, but also a highly oxidisable oil, capable of imparting the odour of rancid grease to the whole mass. Only the inner farinaceous part of the grain should therefore be used for human alimentation, and it should be the aim of the miller to completely eliminate from his flour all the other parts. These, however, need not be lost, for as animals have a larger range of digestive power than man, it is possible that the materials we may properly reject from our bread, may be received again when transformed into flesh.

WEATHER AND CROP REPORTS

FOR THE

Week ending 24th June, 1885.

General Remarks.—Good rain is again reported from Madras, where agricultural prospects are generally fair, and have improved in the districts in which they were most unsatisfactory. Harvesting is in progress in a few districts. In Mysore and Coorg rain has been general: the crops are in fair condition in Mysore, and promise well in Coorg.

In some districts of the Bombay Presidency good rain has fallen, but in most places it has been insufficient for sowings. Kharif preparations are in progress in twelve districts.

Rain has fallen in the Berars, Hyderabad, and in most parts of the Central India and Rajputana States. Cotton sowing is in progress in the Berars; and kharif and rabi ploughings have commenced in Hyderabad. More rain is required for the crops in parts of Central India and Rajputana. Slight rain is reported from the southern half of the Panjab: kharif ploughing and sowing are in active progress. In the North-Western Provinces and Oudh slight rain has fallen in most districts: ploughing operations have commenced. In the Central Provinces there has been good rain in most districts.

More or less rain has fallen throughout Bengal in sufficient quantities for present agricultural needs. More rain is, however, wanted in parts of Behar. Standing crops are growing well, and sowing of amun paddy is in full progress. In Tipperah considerable damage is said to have been done to the crops by floods; and in Dacca also some damage is apprehended on lowlands. The continuance of wet weather in Assam has proved injurious to the crops in Kamrup and Sylhet; but more rain is wanted for tea in Dibrugarh. Ploughing and sowing

operations continue. In British Burma the weather is seasonable, and ploughing is in progress.

The public health is generally fair in most provinces.

Prices are still high in Bengal, and are fluctuating in the Panjab; elsewhere they are generally stationary.

1st *July* 1885.

GENERAL REMARKS.—Heavy rain has fallen in Malabar and Travancore, and slight rain elsewhere in the Madras Presidency. Prospects have slightly improved in Bellary and Anantapur and are generally fair. In Mysore rain has been general, except in Tumkur, where more is wanted. Prospects in the Province are fair. There has been heavy rain in Coorg, where prospects are good.

Several districts in the Bombay Presidency report good rain, but more is urgently wanted for sowings in most places. Kharif preparations continue in several districts. In the Berars and Hyderabad some rain has fallen. Rain has also fallen throughout the Central India and Rajputana States. In the latter kharif ploughing and sowing are reported to have commenced.

Rain is reported from most districts in the Panjab and from all parts of the North-Western Provinces and Oudh. Kharif operations are in active progress in both Provinces. In the Central Provinces good rain has fallen everywhere, except in Nimar, where more is wanted. Sowings for the kharif are in general progress.

Good rain has fallen throughout the Lower Provinces, except in parts of the Patna Division, where the fall has not been quite sufficient. Prospects are now generally favourable, except in Tipperah, where excessive rain and floods have caused much damage. Standing crops are doing well, and agricultural operations are progressing favourably. In Upper Assam more rain is wanted. Standing crops are doing well. Preparations for the sali crops are in progress. Tea is doing well in Cachar, but is backward in Dibrugarh.

In Britsh Burma ploughing and sowing have commenced in a few districts, but excessive rain has interfered with agriculture in Tavoy.

The public health is generally fair in most Provinces; and prices are, on the whole, stationary.

8th *July* 1885.

GENERAL REMARKS.—More or less rain is reported from all parts in the Madras Presidency, and prospects continue fair in all districts except Bellary and Anantapur, where more rain is needed. In Mysore rain has been general, but in Tumkur and Kolar more rain is wanted. Except in these two districts, standing crops are in fair condition. Good rain continues to fall in Coorg, and prospects are good.

Throughout the Bombay Presidency the rainfall during the week was scanty, and sowings and rice transplantation are being retarded nearly every where. In Surat, Ahmednagar and in parts of Bijapur and Belgaum the crops already sown are withering for want of rain. Fodder is scarce in two or three districts. Some rain fell in the Berars, but more is wanted for kharif sowings at Akola. No rain is reported from the Nizam's Territories, where however there is only one reporting station. Slight rain was general throughout the Rajputana States, and prospects are generally favourable. Rain fell at some places in the Central India States, but was heavy only at Sehore and Bhopawar. Prospects continue good.

In the North-Western Provinces and Oudh good rain fell in most districts. Kharif sowings are going on and prospects are favourable. Moderate rain fell in most districts of the Punjab, where kharif sowings are in general progress. In the Central Provinces a break in the rains has been very beneficial for sowings. In Nimar, however, more rain is much wanted.

Seasonable rain has fallen throughout the Lower Provinces, and agricultural prospects have improved generally, and especially in Behar. Standing crops promise well, and the cultivation of land for amun crops is in full progress in places. Transplanting of amun seedlings has begun in Cuttack and Pooree, where, however, considerable damage has been caused to crops on riparian lands by floods. In Assam rain was general, and prospects continue fairly good. Seasonable weather prevails in British Burma, where ploughing is in general progress.

The public health is fair in most Provinces. Prices are still high in Bengal, and have risen slightly in the North-Western Provinces and Oudh. Elsewhere they are generally stationary.

15th *July* 1885.

GENERAL REMARKS.—In the Madras Presidency slight rain has again been general. Prospects have somewhat improved in Bellary and Anantapur and are fair elsewhere in the Presidency, though more rain is wanted in the places. Harvesting continues in a few districts. In Mysore more rain is still required in parts of the Tumkur and Kolar districts, but elsewhere the crops are in fair condition. In Coorg prospects are good.

Rain has fallen in parts of several districts in the Bombay Presidency, though the rainfall up to date is everywhere, except in Kanara, much below the average. More rain is urgently required for sowings in most districts. Rice transplantation has commenced in Colaba and Ratnagiri, and kharif sowings are in progress in parts of Surat and Sholapur. Fodder is scarce in several districts. More or less rain has fallen throughout the Berars, Hyderabad, and the Central India States, and agricultural prospects are generally good. In Rajputana rain has fallen in a few places only, but more is needed for kharif operations, which have commenced.

Good rain has fallen throughout the North-Western Provinces and Oudh, and has been very beneficial to kharif operations. Prospects are good. In the Punjab and the Central Provinces moderate rain has fallen in most places. Kharif sowings are in general progress in both Provinces.

General rain is again reported from Bengal, where crop prospects continue favourable. Transplanting of late rice is making good progress in the Province, in Cuttack and Pooree; but lands inundated by late floods are being resown. Good rain is reported from Assam; transplanting operations are in progress, and sugarcane and tea are doing well. Seasonable rain continues to fall in British Burma, where ploughing is now in general progress.

Public health is, on the whole, fairly good, though cholera, small-pox, and fever are reported.

Prices are generally steady, except in Bengal, where they are still high, but with a slight downward tendency in some districts.

THE

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OF

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In reply to enquiries made this time last year by the military department of British Burmah with reference to fodder supplies in Burma, Mr. Cabaniss, Assistant Director of Agriculture, recommended the cultivation of crab grass and gave the mode of cultivation for certain plots of land named by the Military Department. The system of cultivation then recommended has this season given an outturn of nine tons an acre for the first cutting of green grass. This variety of grass will give two cuttings per annum, one during the month of July and the other in October. The upland soil of Burma appears peculiarly to suit the growth of this fodder crop. It attains the height of three feet and completely covers the ground. Horses and cattle of every kind eat it with great relish and will remain in good condition fed on it without other grain. The mode recommended to the Military Department was that the land should be ploughed twice at the beginning of the rains with a turn plough and then harrowed twice with a triangular harrow. No other cultivation is necessary; nor is it necessary to sow the seed. The grass will germinate of its own accord.

Mr. A. C. Sen of the Bengal Agricultural Department is going to open we hear an Experimental Station in Burdwan. The Burdwan Raj has consented to pay Rs. 1000 towards meeting the expenses of the proposed farm. The Demonstration Farm at Dumraon and the Experimental Station at Burdwan, under the able management of Messrs Allen and Sen respectively will no doubt prove eminently successful. We congratulate the new Bengal agricultural department on the energy and earnestness with which it has begun to work. Besides the Burdwan Experimental Station, Mr. Sen has arranged to open about two dozen more Agricultural Stations in the districts of Burdwan and Hugli, where trial will be given to new staples, improved system of cultivation, different kinds of manure, etc. Bones have been collected and stored in a depot where they are burnt into ashes, which will be used for manuring different kinds of crops.

It is one of the signs of the times that the people of India are beginning to take increasing interest in matters relating to agriculture and arts. We have before us the first three numbers of the *Journal of the Agricultural Students' Association*, a monthly journal devoted to purely agricultural matters and published in Madras. In the first or April number there is an instructive paper by Mr. C. K. Subba Rao on dry cultivation in the Presidency of Madras, and in June number another by the same author on the cultivation of *Ground-nut* (Arachis hypogæa), which will be read with great interest on this side of India and which we reproduce in another column. We entertain high hopes of this Journal as it is published in a presidency which alone of all the presidencies of India can boast of having an Agricultural College and in which early attention has been paid towards agricultural improvement. If it be possible to maintain the varied interest of the subjects and the high promise of the first three numbers, we can confidently hope, that the journal will confer a real boon to the country. We congratulate the managing committee of the association on their earnestness in

improving the agriculture of the country and on the ability with which the Journal is being conducted. We should like very much to see a vernacular edition of this, since it is really the ryots whom it should be the aim of all agricultural reformers to instruct in the most improved and hence most paying systems of agricultural operations, and the best way of apealing to them is through the vernacular of the country.

*

We have to acknowledge the receipt of a *Catechism* on soil, manure, tillage etc. by Mr. M. B. Rao, Cattle Disease Inspector of Cottarione, Madras, which within a short compass of thirty-one pages contains the essential principles of the science and practice of agriculture. The pamphlet is written in the form of questions and answers which we think to be the best way of apealing to the class of readers for whom the book is mainly intended.

We have received from Mr. A. K. Ray, the newly returned Cirencester graduate, a very interesting paper on the cultivation of *Aus Dhan* or, autumn rice in Bengal, which for want of space we have been obliged to keep back for insertion in the next number.

*

In opening the Forest Commission, Lord Reay the new Governor of Bombay said that agricultural problems had always struck him as peculiarly interesting and the more one looked into the agricultural systems of various countries the more one became convinced that over-legislation in agricultural matters was a mistake. Local wants, customs, systems and village tenures had best not be wantonly disturbed, unless very good cause was shown, Being a Scotchman himself and accustomed to give the most respectful consideration to the experience of shrewd farmers, shepherds and farm servants, he approached agricultural questions with a breadth of views not commonly observed in a Governor. He believed that if Forest conservancy tended to increase the supply of fodder and fuel for the people of the country, the enterprize would meet with support and have their sympathy. His chief object was to substitute co-operation for antagonism, confidence for distrust, contentment for disturbance. It is a really gratifying sign of the times that the grievances of the ryots whose cries seldom reach so high have been able to attract the attention of the Governor of a province.

* * *

While the import of articles of food and drink in India, during the first quarter of the current year, fell off considerably, the exports of such articles increased. Comparing the figures with those for the same quarter of 1884, we find a decrease in the imports amounting in value to nearly 26 lakhs while the increase under the head of export is little short of 66½ lakhs. The principal article of exports under this head is, of course, wheat; which shows an increase of nearly 46½ lakhs. The exports of rice show an increase of 12¼. The United Kingdom took a smaller quantity of rice this year, but there was a considerable increase in the export to Egypt, Malta, Ceylon, and the Straits Settlements. The exports of Indian tea shows a large increase; coffee a falling off. India sent over 30 lakhs worth of tea to the United Kingdom during the quarter; against less than 16 lakhs worth in the same quarter of last year, Coffee shows a falling off. Less than 22½ lakhs worth was exported to the United Kingdom, and less than 23¼ lakhs worth to France. We sent over 2¾ lakhs worth to Arabia and Turkey in Asia; a good deal of which was doubtless re-exported as the best Mocha.

The instructions contained in a circular regarding the repression of foot and month disease, issued by the French Ministry of Agriculture, are very much what we need in India presently. Inspectors are warned that obedience to the law must be enforced by severe measures; that the egregious folly of owners in concealing the presence of the disease must be checked; and that the farmers must be made to understand, that in seeking to elude the application of the rules—the sole object of which is to protect their own interests—they show a culpable disregard of their duty towards their fellow citizens. The time has come for the Indian Government to take the matter in hand. It can no longer overlook the importance of the interests involved, and the loss—most of it, we believe, preventible by rather simple means—which is annually occurring. The beginning must necessarily be small; but a start must be made, and a complete scheme gradually worked out as experience is gained.

From the accounts of the trade by land of British India with foreign countries for the first two months of the current financial year, as compared with the corresponding period of last year, it appears that the total value of imports was Rs. 87,96,151 as against Rs. 89,51,675. The increase was almost entirely due to an improved trade with Nipal, and the largest decrease was in the trade with Upper Burma and Karenni. The value of exports was Rs. 1,45,75,488 as against

Rs. 1,08,55,167, which was principally due to the increased trade, trans-frontier, by the Sind and Pishin State Railways. There was also a satisfactory increase in the exports to Upper Burma and Siam, whilst those to Kabul and Nipal both show a considerable decrease.

During the year 1884–85 the value of foreign imports of merchandise to British Burma was Rs. 3,69,53,834 and of treasure Rs. 3,80,121, or a total of Rs. 3,73,33,955. The value of imports in the coasting trade was Rs. 3,12,69,845 and of treasure Rs. 88,08,776, or a total of Rs. 4,00,78,621. The value of private exports to foreign countries during the year was Rs. 5,28,71,688 and of treasure only Rs. 4,700, or a total of Rs. 5,28,76,388. The value of exports in the coasting trade was Rs. 2,07,74,122 and of treasure Rs. 1,07,73,160, giving a total of Rs. 3,12,47,382. This shows a grand total under the heading of imports and exports of Rs. 16,18,36,246, whilst the total for the previous year was Rs. 18,79,25,404. In fact the total for the past year was much smaller than that of any year since 1880–81. The explanation given for the decrease in exports is that the rice crop was a small one, and that there was a depression in the rice markets of Europe throughout the year, while the import trade had been previously much overdone. The unsettled state of affairs at Mandalay during part of the year is also assigned as a cause for decrease in imports. The falling off was most marked in the case of cotton and woollen goods, guny bags, machinery, metals, tobacco, and betelnut.

A note by Mr. Cabaniss, Assistant Director of Agriculture of British Burma, on cigar making in that province, will be read with interest. Mr, Cabaniss personally inspected a number of the manufactories of cigars in Burma, and also a large number of cigar makers working at their own houses. The cigar makers generally purchase tobacco of two qualities: the first quality for the wrapper, which frequently costs ~~Rs~~ 120 per 100 viss, and the second quality for fillers, or the inside of the cigar, at prices varying from Rs 60 per 100 viss. If mixed qualities are purchased at about Rs 90 per 100 viss, the sorting of leaves has to be done by the makers themselves. Mr. Cabaniss tells us that the smoking property of the second quality, is quite as good as that of the first quality, the large difference in price being entirely due to the leaf of the latter being larger and more suitable for making wrappers. A great deal of waste is occasioned in cutting the wrappers, though the trimmings from these are often worked in as filling. A larger quantity of the leaf is more or less damaged when made into cigars by the use of an impure gum or paste for fastening the wrappers. This soon becomes sour, and the cigar becomes mouldy and unsaleable. Notwithstanding all this waste, the prices charged for the cigars, leave a large profit. Mr. Cabaniss thinks that, by tho introduction of a more careful system of working as recommended by him, the price could be reduced to eight annas a hundred.

The Bombay Government have issued a Resolution nominating a Commission to inquire into the operation of the Forest Laws in the Thana District. Of the seven members two are non-official; and while the Forest Department is adequately represented in Colonel Peyton and Mr. Wroughton, a due sense of proportion has been observed in constituting the Commission. The instructions provide, generally, for an investigation into the complaints of the forest tribes and villagers, and into the best means of supplying their legitimate wants in the matter of forest produce and they invite suggestions as to the means whereby the regulations may best be made intelligible to the people, and hearty cooperation be secured in their enforcement. Then there will be special inquiries into the uses of rab and the best means of procuring it—inquiries in which the co-operation of Mr. Ozanne, who has lately given much time and thought to the matter, will be of much value. The merits of the latter are being discussed in detail in the pages of this journal and our readers will be in a position to judge for themselves.

We learn from the Times of India that during six months ending 31st December last, 162,786 bales of cotton were exported, as compared with 227,241 bales in the same period the year before—a deficiency of 64, 455 bales. The first six months of the year saw an addition of only 627,643 bales, whereas last year the exports to 30th June were 1, 668,271 bales, a falling off of 440,628 bales, a total decrease in the twelve months of 505,803 bales. We have to look back a good many seasons to see such a small export in the first six months of the year. As the following table shows, the crops of cotton throughout India were deficient, the aggregate receipts at Bombay being but 954,156 bales, as compared with 1,477,012 in the first half of last year and about a million and a half bales in each of the same periods of the preceding two years. Want

of space prevents our giving in detail the ports to which cotton went from all India in the same period, but we annex a comparative table showing the sailings from each port to Europe, China and other foreign countries in the first six months of this and last season and for the entire twelve months of last year:—

	1st Jan. to 30th June. 1885. Bales.	1st Jan. to 30th June. 1884. Bales.	Total. 1884. Bales.
Bombay ...	652,508	1,119,975	1,292,469
Kurrachi...	28,340	7,764	8,198
Calcutta ...	82,960	139,159	150,225
Coconada...	10,956	9,848	26,819
Madras ...	3,873	26,758	62,579
Tuticorin...	37,493	41,923	99,862
Total Bales	807,6*3	1,345,417	1,640,546

Kurrachi and Coconada alone show an increase, the net decrease from all ports, this season, being 537,794 bales.

* *

At the meeting of the Victorian Chamber of Manufactures, held on the 1st June, Mr. R. Walpole read a paper on the benefits to be derived from the promotion of trade between India and Australia :— There were, he observed, seventy-four cotton mills in India, in which 62,000 operatives were employed. These mills were now nominally without protection and were able to maintain their existence. That was, he thought, the proper sort of protection. India promised to become one of the greatest manufacturers of Australian raw products in the world. As to wheat, the area under wheat in India was equal to that under grain in the United States, and gradually this industry was becoming more important in India on account of the demand for export. Experts had gone to India from the United States to report on the wheat industry, and one of them had stated that in a few years Indian wheat would drive American wheat out of the markets of the world. But South Australian and Victorian wheat would always be saleable, because it was necessary to mix it with other sorts to make good flour.

He referred to several other Indian productions, including bamboo, which was most extensively used there. It gave a heavy crop of fibre to the acre. The annual exports of tobacco (leaf and cigars) had amounted to £160,000. Indian cheroots and cigars were superior to many that had a world-wide reputation. Barley was grown in large quantities, and excellent beer was made to a large extent on the hills. But they lacked hops. In Cashmere hops were grown, but not in sufficient quantities to supply the Indian demand. Teak timber was another valuable product of India. The cultivation was a comparatively new industry in India, and now it was one of the most important industries there. As regards the consumption of Indian products, Australia stood high on the list, but as regards exports of produce to India, Australia was very low on the list. The amount of Chinese tea exported to Australia immensely exceeded the amount of Indian tea received here. There existed in India a great desire to encourage trade with Australia. India belonged to the empire. If England was at war with China, the Chinese-Australian trade would be stopped. We were accustomed to get tropical products from other places outside the empire, which could be obtained from India.

* * *

As to exports of Australian products to India, he was informed in India that the standard of Australian horses sent there was deteriorating; that Australia was growing "weeds" for racing purposes, the result being that the animal sent over was deficient in bone and sinew and too leggy. More trade might also be done in Australian copper, coal, beer, and other products, including fruits, vegetables, dairy produce, and flour. It was singular that India should import flour, but such was the case. As to dairy produce he noticed that Australian cheese factories were sometimes unable to continue operations, because they could not dispose of their products. He had failed to taste in India meat of as good a quality as he had eaten here, and the question as to whether it would pay to send refrigerated and tinned meat there ought to be well considered.

* * *

We beg to acknowledge with thanks the following publications

1 Report on the Measurement of Rates of Growth of Casuarina in the Nellore District, 1884.
2 Annual Report, Government Experimental Farm, Hyderabad, Sind, for the year ending 31st March 1885.
3 Annual Report of the Khandesh Experimental Farm for the Year ending 31st March 1885.
4 Returns of the Railway Borne Traffic during the quarter ending 31st March, 1885, Central Provinces.
5 Extract from a Letter on Sugarcane Cultivation, by Messrs. Burrows Thompson and Mylne of Beheea.
6 Journal of the Agricultural Students' Association, Madras. Nos. I. II. and III.
7 Catechism on Soil and Agricultural Operations by Mr Bhavani Sankar Rao, Madras.
8 British Burma Gazette, 8th of August 1885, Crab grass cultivation.
9 Report on the Silos at the Cawnpur Farm.
10 Proceedings of the Meeting of the Agri-Horticultural Society of India, held on the 22nd July 1885.
11 Government Circular on Fibres and Silk. No. $\frac{124.F.S.}{21-12}$
12 Papers on Silos in Burma
13 Reports on Experimental Cultivation at Paletwa and Kyaukpandaung in the Arakan Hill Tracts, British Burma.

THE returns of railway-borne traffic in the Central Provinces during the quarter ending 31st March, 1885, show that the total amount of goods imported were 7,23,881 maunds, the principal items being salt, sugar, metals and cotton goods. Practically the whole of the salt and 80 per cent. of the fine sugar came from Bombay. But 80 per cent. of the total sugar import consisted of the coarse compost known as *gurh* and for this North-West Provinces and Bengal were drawn upon. The metals and cotton goods were principally derived from Bombay, being for the most part European goods imported *via* Bombay. The total amount of goods exported during the same period was 48,75,208 maunds, the principal items being coal, wheat, rice, gram, linseed, tilseed and hides. Wheat constituted more than half the traffic. It was practically speaking all consigned to Bombay. The *linseed* was all taken by Bombay. More than half the quantity of *hides* exported was subscribed by Chhattisgarh, the result of the greater mortality amongst the cattle of that tract during the preceding rains. Besides that borne by the railway, a good part of the traffic, especially in the Shambalpur and adjoining districts, is in the hands of petty dealers who buy wheat, grain, rice and other articles of commerce at a time when they sell very cheap and float them down the Mahanadi to Katak, whence they are exported to Calcutta. A few do a good stroke of business who collect such raw materials of the country as hides, horns, lac, nuts (Terminalia, etc.) and export them to Calcutta *via* Katak. But much of these are now being wasted which with improved communication will be a means of enriching the country and of finding occupation for people who are now pressing upon land.

FROM the reports on experimental cultivation at Paletwa and Kyaukpandaung in the Arakan Hill Tracts during the past two years, we gather that at Kyaukpandaung, generally speaking, tea and cinchona thrive well and may be cultivated with success. The tea garden is already assuming large proportions, the number of trees and young plants exceeding 14,000. There are over 400 cinchona plants all doing well. Coffee and potatoes have not been a success at either of the above stations. At Paletwa the cultivation of tea, pepper vine, cinnamon, Liberian coffee, and Manilla hemp has been successful. According to Mr. Fanshawe's suggestion sugar-cane, tobacco and cotton cultivation will be tried during this year. The experimental cultivation has shown that it is possible to grow varied products in the Hill Tracts, but there is no hope of attracting there, for the present, European settlers as the labor difficulty and climate are obstacles to any successful planting enterprize; the hill men may however be induced to grow staples which are useful and necessary to them, such as sugar-cane, tobacco and cotton, and if the result of these experiments is to introduce the permanent cultivation of these products among hill men, the money expended on these grants will not have been uselessly spent. The Chief Commissioner agrees to continue for another year the grant of Rs. 1,000 for experimental cultivation at the above two stations but he trusts that the grant will be expended on the introduction of products which are of immediate use to the hill people.

IN the Bhadgaon experimental farm in Khandesh in the presidency of Bombay, 10 acres of good uniform land measured off into eight-guntha* plots were set apart last year for purely experimental purposes. To provide against accident, duplicate plots have been used throughout. Two plots were experimented with wheat, cultivated on the Lois Weedon system which consists in raising crop year after year on the same land, thorough tillage being alone substituted for manure. To compare this system of cultivation with the system ordinarily practised in the country, 4 plots were ploughed and prepared exactly in the same manner, of which two were sown with an ordinary sample of the dry-crop wheat of the district at the rate of 70 lbs. per acre and the corresponding pair with the same seed but at the rate of 35 lbs. per acre, 3 lines being sown and 3 left unsown alternately, thus giving only 30 rows per plot as against 60 in the former pair. The interspaces or lines that were left unsown were carefully stirred from time to time; those of this year will be cropped next year and the strips under crop this year will be fallow next. Estimating the outturn of the four plots, it is apparent that the yield of the two half-sown plots was considerably more than half of that obtained from the plots fully occupied. The trial given to the Lois Weedon system was no doubt a success but from the result of one year it is impossible to say anything positively one way or the other. The system has its advocates no doubt in the United Kingdom but is very sparingly resorted to in practice.

THE other crops grown on the experimental area were jowar, gram, country wheat under different kinds of rotation, foreign wheat, sugar-cane, and tilly (til). "Hard Red" and "Bansi" are the

* 40 gunthas = one acre.

standard wheats of the district, the one for *dry* cultivation, the other for irrigation. It is worthy of notice that in point of fruitfulness these two kinds stand out far ahead of the best of the others. This along with the fact that foreign or transported wheats grown on the farm were practically all failures, has a negative value in so far warning agricultural reformers against too hasty introduction of foreign or transported staples, however good the latter may be in their own locality. In one plot green hemp was ploughed in as a manure in preparation for wheat, but the result was very disappointing; the green manure plot came out the worst of all. But from a single experiment like this, nothing can be positively stated. Two plots were occupied with Sorghun, the first with ambercane of recent introduction from America, the second with blackseeded or Chinese Sorghum grown on the farm for the past 13 years. The out-turn of both was satisfactory but the juice refused to become *jagri*. In one part, the report goes on to say "In the burning of cow-dung, the cultivator no doubt loses something in the shape of manure: the ashes however which are carefully restored to the soil are capable of giving results not very much inferior to the fresh article." The cultivator does not however in the process of burning, lose only something but the most important and valuable thing in the manure. One ton of an average sample of farm-yard manure usually contains 9-15 lbs. of nitrogen, a similar amount of potash and 4-9 lbs. of phosphoric acid. Of these three manurial constituents, nitrogen is about 12 times more valuable than the others and in the process of burning this valuable part is entirely lost. So "much of what is written about the wicked use of cowdung fuel" is not far short of truth.

BESIDES the crops grown on the experimental area, four varieties of cotton (American, Nankin, Hingagghati, and Waradi) were sown on 184 acres, jowari on 42 acres 5 gunthas, bajri on 41 acres, wheat on 54½ acres, tilly (til) on 77 acres, linseed on 24½ acres, and other miscellaneous crops such as American corn, Sholapur and Satara maize, Golden trees, turnips, tobacco and sugarcane. The linseed and wheat crops were very much injured by a sort of fungoid disease called *girwa* to prevent which the seeds were pickled before being sown; the pickles used were (1) human urine, (2) sulphate of copper, and (3) common salt. The arrangements made with regard to the first having failed at the last moment, the second and third were proceeded with. The result was that the sulphate of copper was much more effective than common salt. Lucerne, sorghum, Indian corn, and other such succulent crops are considered to produce the best silage but seeing that in Khandesh these may be had ready for use at any desired time of the year, the benefit of cutting and storing them in pits is not obvious. Only meadow grass was used and such herbage as under ordinary circumstances is fully much a waste substance. Under the head of Arboriculture, carob tree (Ceratonia Siliqua), Divi Divi (Cæsalpinia Coriaria), Arabian Dates and Manilla Tamarind (Inca Dulcis) are being tried. In the part of the farm devoted to live-stock, there were cows, bulls, steirs, heifers and calves belonging to three distinct breeds *viz.* Thillari, Aden, and Malvi, besides crosses and buffaloes. The Aden cattle seems well fitted for domestic purposes but is not sufficiently hardy for the rough life of ordinary Indian cattle. There was also a good flock of sheep, the strength of the flock being 168 on the 1st of April 1885.

THE Government experimental farm at Hyderabad in Sind similar to the one at Khandesh, is divided into two parts, one devoted to crops grown for experiment and the other to crops grown for the market or for selected seeds etc. The crops grown for experiment were cotton (Nankin, American and Sindi), wheat (18 varieties), jowar (6 varieties), bajri, tobacco, linseed, gram, buckwheat, mangold (8 varieties) ganjar or gajrum (Daucus carota) and palik (Spinacea oleracia). In the cotton area, experiment was made to show the comparative value o selected and unselected Sind cotton-seed. The plants from the selected seeds did not yield any thing like the quality of cotton one who would have expected from them. They were not so hardy as those raised from selected seed and could no stand the effects of frost which came on in January In selecting bajri seeds for the current year's sowing the grain from the middle portion of the selecte ears only has been kept as suggested by the Directc of Agriculture, but the Superintendent of the farm seems to have no faith in the efficacy of plumpe and better developed seeds from the middle of selec ed spikes and gives a lengthy quotation from th *American Agriculturist* for May 1885 to suppo his fancy. The remarks in the *American Agr culturist*, he himself acknowledges, refer to India Corn but to suit his purpose he infers that t samething is likely to hold good with bajri, b cause bajri and Indian Corn are both cerea Whatever may be the result of this particular e periment, to say that better developed a plumper seeds have no effect in improving stap

generally is not to accept one of the first principles of agricultural science. However, we wait to see the result of this selection which is likely to clear the point. In the wheat area, trial was given as in Bhadgaon farm to the Lois Weedon plan which seemed to come out best by a long way so far as the grain return is concerned and not much behind the plots which got double the quantity of seed and where all instead of half the ground was under crop. All the varieties of wheat were very badly attacked by *rust* but some of the Sind kind though alongside of the most diseased kinds from Bombay were but little affected by it.

In our article on "Steam Threshing," a question raised by the writer was whether red wheat will turn to white and *vice versa* under the influence of soil and climate, and whether hard wheat will become soft and soft hard under similar conditions. To determine this point certain varieties were grown last year but longer experience is necessary in order to be able to say anything definitely on the point, though it is not at all unlikely that both soil and climate do effect a change in the color of wheat as well as in the hardness and softness of the grain. After harvesting potatoes, English farmers generally store them up by pitting or in other words by heaping them up in the form of a triangular prism and covering the heap with alternate layers of straw and earth. The same seems to have been done with the potatoes in the Sind farm but when dug up it was found to be all quite rotten. Trial was also given to a continental crop named Buckwheat. In England this crop is sparingly grown for fodder but in the continent, especially Germany, it is grown on a large scale, the flour made from its seeds being largely used by the poorer class of people to make bread. The crop however was a total failure in the farm. But we wish a few more trials be given to the crop under altered and more suitable circumstances than before. An experiment was also made for ensiling jowar and bajri. The silage produced was only a kind of passable substitute for the fresh thing. Of turnip, four varieties were sown *viz.*, Italian, golden ball, Dutch yellow and a large soft red topped kind. The golden ball had the best and the healthiest bulbs but none of them produced seeds though all flowered sparsely. During the past year no new implements were obtained.

There was no other cattle on the farm than the working bullocks. The Abyssinian sheep received in the farm were not what were wanted and never seemed to thrive well in that part of Sind. They want shade in the hot season and the tough "dub" grass does not seem to agree well with them. Under the head of arboriculture, a small beginning was made, a plot fourty-five and one-third acre in area was acquired for *babul* growing, for which the land is naturally suited; most of it can be flooded at will during the innundation season. To the farm is attached a vernacular agricultural class in which last year there were ten students, six of whom passed the examination at the Hyderabad Normal School.

In Burma labor being dear and grazing land free, there seems to be no necessity for ensiling green food on economical ground, although it has been clearly proved that if necessary green food can be successfully preserved in that way. Mr Cabaniss, Assistant Director of Agriculture, says that silos are principally useful (1) when it is necessary to preserve cattle food for a time when the soil does not produce it, (2) when it is cheaper to take a large quantity of cattle food from a small area of land. Thus we have in Thibet (the place where, ensilage is supposed to have first originated) a small area of cultivable land for a short time of the year only, so that the requirement is to save the food rapidly so as to get a second crop from the land if possible, and also to preserve green food for a time when the soil does not produce it. In America we have a large quantity of green food for cattle available in summer and none available in winter. The facilities for saving the silage by machinery also add to advantages in America. In India the rains might be compared to the summer of America, as it is the time of plenty, and the dry season to the winter, as it is the time of scarcity of cattlefood. Cheapness of labour in India compared to relative value of land in India also takes the place of advantages of machinery in America. In England and France, land is valuable compared to labour, and this favours ensilage; while in Burma, it is just the reverse, labour being expensive, and land (for grazing) free.

* * *

The Chamber of Commerce at Lyons in France intends to prosecute a series of studies on sericulture and asks for co-operation from India. It has sent a series of questions on natural history and cultivation of silkworms with a desire to find out if possible (1) the genera, species, and varieties

of the domesticated, semi-domesticated or wild worms and (2) to ascertain the richnes in silk of cocoons, envelopes or silky coverings, the nature and quality of the silk obtained and in particular the colour, fineness, tenacity, elasticity, yield of raw silk, and the aptitude for taking dye, etc. India possesses several species of domesticated silk worms which are still at the present day unknown in Europe. Besides she has other silk worms which are interesting in more respects than one. We hope the Government of India, the several local Governments and individuals having special knowledge of sericulture will come forward and help the Chamber of Commerce in the noble undertaking which it has taken in hands.

At the Cawnpur Agricultural Station, 13 silos were filled with fodder for ensilage, between the months of September and December last year. Three of these were old masonry pits built some years ago in connection with a scheme for subsoil drainage and the remaining 10 were merely holes of various sizes and shapes, especially dug for the purpose, in a plot of elevated ground. Over 7 of the 10 silos thus dug, cheap straw thatchings were placed for protection. The other three silos were protected by tile roofs and covered over by conical mounds of earth to a height of from 3 to 4 feet. Jowar, sorghum, dubgrass, and Guinea grass were the fodders ensiled. A small portion of the jowar had been cut in flower but the greater part of it after the grass had got well on towords ripening. The other crops were cut in flower. The silos were filled gradually in layers, two days being generally allowed to intervene between the successive fillings. On opening the pits it was invariably found that, with the exception of a mouldy crust of about six inches thickness on the top and round the sides, the fodder had been well preserved and freely eaten by cattle.

AGRICULTURAL IMPROVEMENT.

II.

III.—Application of the general laws thus found to agricultural practices:—In an advanced country like England with its enlightened and well-to-do peasantry and landlords anxious to see the land cultivated in the most approved method, the duty of the Government might stop with making experiments, deducing general laws and pointing out their bearings on agricultural operations. But in India this would not be at all sufficient. The risk of the first application of these laws to farming operations must also be borne by the Government. Side by side with the Experimental plot therefore there must be a Model Farm where the results of the field as well as of the laboratory experiments should be tested by their application to actual agricultural practices. The model farm must be an example of the most scientific and therefore the most profitable way of cultivating land. The peasants of India must not be simply told that by so altering the tillage operations, putting in such and such manures, selecting the seeds with proper care, he can greatly increase the produce of his field and make a better profit, but an example should be placed before him where this has actually been done. If this could be done, it is impossible that the peasants of India, notwithstanding all that has been said or written of their prejudices and ignorance, would be slow to take advantage of it.

IV.—Diffusion of a better knowledge of the theory and practice of agriculture:—When we speak of agricultural education it is to be noticed that we unconsciously refer to a great change that has taken place of late in the mode of imparting knowledge in arts and manufactures. In former times almost all professions were hereditary; children were employed at an early age by their parents to assist them in their works and in so doing they learned the family professions slowly but with a degree of exactness that cannot be surpassed. This method it is evident cannot be dispensed with and so it has been retained in the modern "apprenticeship;" but we have added to it a supplement which has lessened to a great extent the slowness of the process without materially interfering with its exactness. We have placed industrial schools side by side with workshops, the one intended to teach the principles and general laws involved in different arts and the other where students learn the practice. If judiciously conducted, there can be no doubt of the superiority of the modern method, though it cannot be denied that most ridiculous attempts of teaching industrial arts without the aid of workshops have sometimes been made. With this preliminary remark we shall divide the subject of agricultural education into that of college or higher form of agricultural education and that adapted for elementary schools, and take up each separately.

1st College education:—We shall bring forward a few arguments to prove the necessity of establishing a college of agriculture in each province specially Bengal. (a) There is no doubt that much good may be done for the improvement of agriculture in Bengal by means of experimental farms, economic museums, agricultural shows and occasional publi-

as the hoeing of the ryot's field has to be done by men; if water is now necessary, a little is allowed to flow from one end of the channel to the other and then shut off; as the plants rise more earth is filled in around them with a little manure where it may be needed, the loosening of the surface, watering and filling in are repeated till the channel is filled, after which as the plants grow the earth is drawn from the spaces between the rows and heaped round the roots till a ridge is formed at least 9 inches high over the original surface. Subsequent irrigation is given in the hollows between the ridges, the water not being allowed to reach the top of the ridges by four or five inches, which are thus left friable and open for the action of the air and expansion of the roots.

Our ryots have for years seen and acknowledged the considerable economy of labor, water and manure in this method as compared with their own; they have also seen the common Mongoo cane of the district so improved that they had to be assured it was nothing else, yet none of them have had the enterprize to adopt it though several among them have been at work on the cane fields of the West Indies and Mauritius and know the method and its results.

Cane-culture should be more of the nature of garden than field cultivation, and if done with reasonable consideration of the nature and necessities of the plant, a third of the land now yearly devoted to cane could be put under other crops with no falling off in the weight of sugar produced.

The industry as a whole and in its details from the preparation of the land till the crude produce is ready for the market, is in a very backward and wasteful condition. There is no reason except the inertia of the ryot why this should be so. This might be overcome and a better way opened out by some sustained effort on the part of Government, probably by a graduated set of prizes for the best cane fields cultivated with reference to the nature and requirements of the plant. We know by experience they (the Ryots) will understand what this means when explained to them in terms with which they are familiar.

W. BURROWS.

TO EDITOR "INDIAN AGRICULTURAL GAZETTE."

DEAR SIR,—As the subject of ensilage is attracting a good deal of attention, I venture to send you a few notes about the silos at the Cawnpore Farm which are on the whole the best I have seen in India. The chief facts to which I wish to call your attention have been cast into a tabular form.

No. of Silo	Date on which closed	Date on which opened	Form of Silo	Cost of digging	Cost of roofing and mound of earth for shelter.	Pillars	Cost of chopping	Cost of filling treading and weighting	Total Cost	Fodder filled in
1	2	3	4	5	6	7	8	9	10	11
										mds.
1	12 Dec. 1884	8 June 1885	Circular 6′ diameter, 10′ deep	0 8 0	0 6 0	...	2 2 3	0 15 6	3 15 9	Juar . 71
2	14 Do	18 Do.	Do. Do.	0 8 0	0 5 0	...	1 12 6	0 10 6	3 4 0	Juar . 74
3	18 Do.	Not opened	Do. Do.	0 8 0	0 5 0	...	2 9 3	0 13 0	4 3 3	Juar . 62 Sorgho 23
4	3 Nov. 1884	Do.	Do. Do.	0 8 0	0 11 6	...	1 6 6	0 8 0	3 2 0	Juar . 61
5	7 Do.	10 April 1385	Do. Do. 20′ deep	2 0 0	0 13 6	...	4 13 0	1 10 3	9 4 9	Juar 180
6	11 Do.	Not opened	Do. 13′ diameter, 6′ deep	0 12 0	2 8 0	...	5 3 6	1 8 0	9 15 6	Juar 171
7	6 Oct. 1884	10 May 1885	Elliptical longest diameter 18′ . . . Shortest diameter 10′ depth 11′ . . .	3 12 0	21 4 0	6 6 0	Chopped	3 8 9	34 14 9	Common grass 725
8	1 Nov. 1884	Not opened	Do. Do.	3 11 0	20 7 0	6 6 0	13 13 0	2 8 0	46 13 0	Juar 490
9	22 Dec. 1884	Do.	Longest diameter 25′ Shortest diameter 10′ depth 12′ . . .	6 8 3	22 7 0	7 6 0	20 1 6	4 11 0	61 1 9	Juar 756
10	30 Dec. 1884	12 June 1884	Do. longest diameter 30′ Shortest diameter 18′ depth 13′ . . .	13 9 0	89 10 0	15 13 0	43 13 3	7 14 3	120 12 0	Juar 1416 Guinea grass 416
			Total	32 4 3	108 13 6	35 15 0	95 10 9	24 11 3	297 6 9	4446

You will see that there were ten pit-silos made and filled with *juar* and common grass for rather less than Rs. 30 each. The total fodder stored was 4446 maunds and the cost of the process was therefore but little over one anna per maund. Besides these ten silos, three masonry pits constructed last year in connection with experiments on sub-soil drainage were converted into silos but I will not trouble your readers with details about these *pacca* silos; for the possibility of storing fodder *cheaply* is the only problem that is of practical importance to the Indian cultivator. The pit-silos were circular or elliptical, and the one showing the best results, No. 6 on the list, was opened on the 10th. May. This result is obviously due to the fact that it alone was stored with chopped grass which packs closer than *juar*, and the more air is excluded the better the result. The low water level at Cawnpore on the high ground selected was another advantage, for the greater the depth is, the smaller will be the percentage of the loss which always results at the surface however carefully the fodder is packed. The grass is said to have been cut when in flower, the best time for pitting in a silo, and the silos were filled on the slow system. The method employed was to fill in a layer of 2 or 3 feet, tread down thoroughly, cover with a thin layer of *bhoosa*, and 6 inches of earth, and then leave for two days to settle. After this the earth and *bhoosa* were removed, and a similar layer was stored in the same way. The process was repeated till the silo was full and then finally weighted with from 2 to 3 feet of earth, the amount varying with the depth of the silo. The resulting silage preserved its colour and softness which except at the top and sides fermentation had obviously not passed the acetic stage. In May, cattle preferred it to dry fodder when both were offered simultaneously. These experiments seem to show that slow filling is advantageous where the pits are deep; but I wish that some of the silos had been filled rapidly for the purposes of comparison. This is General Wilkinson's plan, and it should be adopted whenever experiments are carried out for the sake of settling this point. The sides of the Cawnpore silos were slightly sloped, No. 6 for instance having a slope of about 3 feet from top to bottom. The object of this is to facilitate light packing. General Wilkinson however recommends perpendicular walls, and his experience seems to prove conclusively that he is right. Neither his mats nor the layer of *bhoosa* placed at Cawnpore between the silage and the earth appear to prevent surface moulding, and so I do not see the use of the practice; I should like to see a silo packed with the earth resting directly on the fodder.

The temperature of the silage in the one that was courteously opened for my inspection did not exceed 100° and a pony that had never seen silage before ate the chopped *juar* readily. In another case the temperature reached 120°. It is gratifying to observe that ensilage which when first tried at Cawnpore was pronounced a failure, has now given successful results. This is mainly due to the patience and perseverance of Major Pitcher, and his able overseer Babu Lachman Prasad.

The nutritive value of silage is still a matter of dispute. In my opinion it is much lower than is usually ascribed to it in India. The question might be solved at Cawnpore, by dividing a number of bullocks into two lots taking care that the total weight of each lot was approximately the same. Let one lot be fed solely on silage and the other on an equivalent weight of the fodder (*e. g., bhoosa*) with which the operator wishes to compare his silage. Weigh at intervals, and compare the general health and power of work. By this means we can compare the nutritive value of one kind of silage with one kind of fodder, and after a series of experiments we may get to know the proper position of silage among articles of food. Till then the practical man may perhaps as well believe in the universal opinion of all agricultural chemists and not imagine that dead fodder can require valuable properties merely from being enclosed in a dark pit.

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BENGAL.

RAB.

BEFORE continuing the description of rab cultivation I shall digress, and attempt to show how the revenue management of the Konkan was conjectured to have a bearing on the origin of rab, and also to sketch out the reasons why the subject of rab is at the present time so important.

The survey found the Konkan (I especially refer to the Thana District) cultivated chiefly with rice. The area of dry crop exclusive of uplands (Varkas) was insignificant. No attempt had ever been made to measure the Varkas. But each holder of rice-land enjoyed, free of any assessment, the right to use an allotted area for obtaining rab.

The allotment was not made by the revenue authorities but by the ryots themselves, and no official record of it existed. If in the allotment, however, the rice-land holder chose to grow hill crops, a charge in the form of a plough tax was levied. It does not appear that such cultivation

tion of the results arrived at our farms in a form that could be understood even by men of ordinary intelligence and education, but all these will fall very far short of the actual want. To further the cause of agriculture in Bengal, the great want of the present moment is that of a class of intelligent well-educated and if possible well-to-do men taking an earnest interest in everything pertaining to agricultural matters. To create such an interest among the people should be one of the first steps in any attempt at agricultural reforms in the country. The opening of a college where the students will receive instructions not only in the practical operations but in the modern science of agriculture as founded on some of the most important discoveries of Chemistry, Geology, Botany and Physiology, is we maintain the sure and the only way of doing this. (*b*) Again the educated classes in Bengal and we fear all over India are finding it more and more difficult to give a satisfactory answer to what has become to many of them the question of questions, "how shall I live." This no doubt is partly at least due to an inherent defect in the system of education that obtains in our colleges, namely, that the kind of education that our young men receive is not well adapted to their means and requirements; it is too theoretic and purely scientific for the comparatively poorer classes of the native community from which our colleges are mostly recruited. Measures that will help the graduates of our university in following independent professions ought to be greatly fostered. A knowledge of agriculture in our opinion is most calculated to have such an effect. (*c*) "The necessity of having special colleges and schools where students are to be instructed in the science as well as the practice of agriculture has been admitted in all civilised countries. " Agriculture is now a science or rather the application of a number of sciences and requires as wide a range of scientific knowledge as any learned profession. Nothing but a college especially organised and equipped is capable of affording the means of acquiring the knowledge which is now necessary for the proper understanding of the scientific principles upon which the varied practice of agriculture rests." In a very able article on " agricultural education " published in the North British Agriculturist we read the following:—

" Government has of late years begun to do something towards speading a knowledge of agricultural facts throughout the masses but as yet all that can be done with present machinery must be very superficial though in the right direction. We have an agricultural class subsidised by Government in Edinburgh University and ably conducted by Professor Wilson, who is possessed of large and varied experience. Yet we should like to see the Government do more than that. We should like to see a few more colleges on the type of the Royal Agricultural College at Cirencester, but with the staff appointed and paid by the Legislator." Special agricultural educational institutions are to be found in every country on the continent of Europe and in America. Even Japan can boast of two agricultural colleges well equipped with able professors, good laboratories, experimental grounds, veterinary hospitals and other necessary appliances. One thing to be noticed in connection with these institutions is that they are all entirely supported by Government grants. Even in a country like great Britain where people of all classes from royalty downwards take so much interest in everything pertaining to agriculture and where such efficient agricultural educational institutions as those at Cirencester and Downton, and agricultural experimental stations as those at Rothamsted, Woburn, Tunbridge etc., exist entirely supported by private bodies, the advantage of having State colleges has been admitted by adding a department of agriculture to the normal school of science at South Kensington. The excellent Government agricultural institution at Glasnevin in Ireland is long in existence. The proposal of teaching the first principles of agriculture in all primary schools has just been considered and approved of by the Royal Commission on Elementary Scientific Education. The British public are yet far from being satisfied. If it be so in Great Britain, it will not at all be too much for the people of Bengal to expect that a Government that has done so much for the education of the people generally, should found at least one college for the instruction in that branch of industry on which more than three-fourths of its population depend directly for their livelihood.

College education however will not reach the really agricultural people of the country. These men generally speaking are not expected to receive a better education than what is imparted in the highest classes of the primary schools. To reach these men therefore something must be done in connection with the primary schools already in existence or those that are to be established in future.

SUGARCANE CULTIVATION IN BENGAL.

THE Government of India wants to know more about Sugar. It draws attention to its Resolution No. 505 A, published in the *Gazette of India* of 10th. June, and complains that the information which it possesses is of an imperfect character. Area statistics for most provinces may be "fairly accurate," but returns of average out-turn are "extremely conflicting" and as for prices there are "extreme diversities" which can only be explained by the theory that reference is made to different qualities of sugar. More information is wanted of modes of cultivation etc. "so at to further the object which the "Government of India has in view, *viz.*, the improvement and extension of the sugar industry of India "and the attraction, if possible, of greater skill and "capital to the cultivation and manufacture of the "article." In order to meet this want, we publish below a note from the well known firm of Messrs. Burrows Thompson and Mylne of Beheea. The experience of these gentlemen who have devoted years to further the very object now required must prove of interest to our readers; and those, who wish to improve the cultivation of sugar and its manufacture, cannot do better than take as their guide the suggestions found in the following letter. We may fairly assume that the procedure described has been proved to be advantageous. All that is required now is to overcome the *vis inertia* of the cultivators, and we can conceive no better employment for the new agricultural Department of Bengal than to diffuse this knowledge as widely as possible and to encourage the adoption of the methods now prescribed by every means in its power :—

The usual Indian method of cane-culture may be called *broadcast* as opposed to *planting*, as the term is understood by European and American planters. The difference in results may be approximately obtained by asking any ryot the difference in produce between "cheetwa" and "roap" dhan (broadcast and planted).

The root of the sugarcane is a small collection of thin fibres or rootlets, there is no tap-root; on these depend the health and vigor of the plant with its long succulent stem and succession of long broad leaves. It should therefore be placed in the best possible condition to enable it effectually to meet the heavy demand on it.

By the native method the root is on or near the surface of the ground. The field gets twelve or fourteen surface ploughings giving a seed-bed only 4 or 5 inches deep. The little manure (if any is given) is scattered irregularly over the surface. A plough goes round the field in a continually decreasing circle and the cuttings are dropped into the shallow track so made. There may be a little manure where they fall, or there may not be any. The cuttings are covered with about three inches of earth by a piece of wood drawn over the surface, a man or two standing on it, each supporting himself by holding the tail of the bullock in front of him; this surface covering soon dries, the surface, is then loosened a little by the hoe the roots being carefully avoided. A little manure may now be placed round each plant by hand, and water is let on till the field is submerged or water-logged, thus sealing up the roots from air in plastic clay or loam compressed by the downward course of the water and hardening as it dries. As the hoe avoids the roots, the compression of the soil around them increases just where it should be most friable. The hoeing is repeated about three times followed by a "Melwanee" watering, that is, till the ground is waterlogged each time. When the plants reach a a certain height and the leaves begin to shade the field, hoeing is stopped and as they grow being close together with no regularity a thick jungle is the result, excluding sun and free circulation of air. Considering the nature of the plant and the work its root has to do, this treatment of it is most irrational.

In Mauritius, West Indies and other places where cane cultivation is under European supervision, the cuttings or seedlings are laid at least 9 inches under the surface of the ground, either in carefully made rectangular oblong holes in rows 3½ or 4 feet apart or in continuous channels or furrows made by hoe or double mould board plough, the bottom being flat and 8 or 9 inches wide, that is, wide enough to receive three cuttings placed some distance from each other; a field planted in this way will take as many cuttings as are usually put in by the native method. The space between the rows need not be ploughed but only cleared of weeds by hoe; these are left on the ground and are covered by the earth from the channels or holes.

Previous to planting the cuttings, manure in proper quantity is spread over the bottom of the channels and mixed with a little earth; on or in this the cuttings are laid end to end either in single, double, or triple rows as the width of the bottom may allow and covered by hand with about 3 inches of earth. The hole system is used in Mauritius, the ground is hilly and undulating, rain is frequent and each hole retains what water fall into it. In India where irrigation is necessary, the channel or deep furrow-method is best. After some days the surface of the soil in the bottom of the channels is loosened by hand; this may be done by women or children, where,

was extensive. The villages were variously circumstanced. In some the area of Varkas was very extensive. In others very limited. There was no strict forest conservancy; though prohibitions against the felling of teak and other valuable trees had long been customary, yet the people freely lopped all trees and used the leaves also at will. No restriction was placed on the ryots beyond the natural restriction arising from the extent of Varkas. It is easy now to see the meaning of the statement in my text that the gratuitous terms on which rab was obtainable encouraged wholesale destruction of brushwood, and the ground of the conjecture that it was from this system that rab originated. The conjecture was based on analogy. Rice is grown without the help of wood ashes in various parts of the Presidency. The Konkan land is not inferior in fertility to many of such tracts where rab is unknown. It may be said on the other hand with the fresh soil washed down from the hill sides yearly by the heavy rain, the Konkan rice fields are peculiarly independent of such a fertilizer as wood ashes. Mr. Day did not lay enough stress on the wood preventing characteristic of rab. That characteristic at once explains how the analogy was at fault and I hope later on to show that there are other similar characteristics.

It may appear strange that no officer, not even Mr. Day, undertook to show the inapplicability of the analogy. *True*, the survey officers more than once maintained that rab was absolutely necessary to rice cultivation but no one attempted to prove its necessity. The reason is clear. At that time it was a matter of comparatively small importance. I will quote a remark by the Commissioner in support of this statement. He said "I do not apprehend that in a country situated as Nasrapur (the first taluka surveyed) is and having the natural features that it has, there is likely to be any scarcity of ground, where rab can be procured."

The survey officers wished to perpetuate the old system. They argued that looking at the large expense that would be involved in a survey of the hill-land, and at its importance, it would be better to leave its apportionment to the people. In order however to avoid "an establishment to assess the plough tax or occasional cultivation and the uncertainty connected with it, it was proposed to levy in lieu of the plough tax, a small extra assessment on each acre of rice land, designed to cover the amount estimated to accrue from that tax and to leave the people unlimited usufruct of the Varkas. This recommendation was not approved; a rough survey of the uplands was directed, in order that the allotted portions might be sufficiently defined to prevent "future encroachments, disputes and uncertainties."

Thus the rice lands and the attached portions of Varkas were demarcated. These latter were designed to cover an area necessary to supply grass and brush-wood for rab. It seems to have been intended that outside this area no usufruct should be allowed. By degrees the extent of rice-land greatly increased. The cultivation of Varkas increased till at the present time, the original object of the Varkas allotment seems to have been forgotten. It is now cropped thus: After a fallow of 5 years or more, *nachni* with rab is taken. This is followed by *varai* with rab and this for another season or perhaps two by inferior grains grown without rab. At the time of survey there were very few instances of holders of uplands, who were not also possessed of rice-lands. Such have become numerous. Population has increased. These considerations make it clear that the original allotments for rab no longer suffice. The people have encroached on the unappropriated Varkas outside, for the rab-producing area has to a great extent become a rab-demanding area. Whether such encroachment was in accordance with the custom of the country or not, I will not attempt to discuss. Of late years a vigorous forest policy has arisen. It was found that the unappropriated hill lands are burdened with varieties of alleged rights, among which rab is one of the chief. Restrictions were placed. Part of the forest was completely closed and part partially. Hence has arisen the present importance of rab and the necessity for study of its merits.

The Limits of Rab.

This portion of the subject has as yet been insufficiently studied. Generally speaking it may be said that rab is confined to districts of heavy rainfall, (say from 80 to 100 inches and over). Kanara, however, which has a heavy fall of rain, appears to be an exception. Rab again gradually disappears in the North of the Presidency, as the district of Gujrat proper begins. Rice is extensively grown both in Kanara and in Gujrat and also in districts, *e g.* Dharwar where the rainfall is much lighter, and even is grown on the transplantation system in which as in the case of rab the nurseries are well manured. The manure is not burnt. In some of these districts, the absence of abundant brushwood may partly account for the absence of rab, but this explanation can not generally hold. Again rab extends over the ridge of the Western Ghauts and is prevalent in Poona, Nasik etc. Another fact bearing on the climatic limits of rab is that where rab is universally practised for sweet rice, it is never

resorted to in the case of salt marsh rice *i. e.* rice grown in reclaimed salt marsh near the coast and on the banks of creeks. This is an inferior variety of rice. In the Poona district, at least, where rab gradually disappears with the decreased rainfall, it seems to come to an end sooner than the cultivation of rice; but here again the fine varieties of rice appear to vanish with rab.

On the whole it may be stated with confidence that rab is confined to districts of heavy rainfall, though the converse is by no means true to facts.

There are clearly other climatic limits than the magnitude of the rainfall, *e. g.* the duration of the rainy season. Rice requires an abundant supply of water till a certain stage of growth has been reached. It would seem then that rab enables the cultivator to secure this need by allowing the seed to be sown earlier than could be done under ordinary circumstances. The *dhulvaph* described by Mr. Day is an evidence of this necessity. Again may be mentioned the practice of causing artificial germination of the seed, which will be noticed further on. I am reluctant to leave this portion of my letter so incomplete, for I believe it is the most important of all. But it is at the same time a subject which will require much study to elucidate in a thorough manner.

Analogous practices.

I.—In India.

There is a system of cultivation on this side of India which resembles rab. It goes by two names, *dalhi* and *kumri*. I will quote the description given by an experienced officer, Mr. A. Shewan C. S. in 1881.

"*Dalhi* * is the form of cultivation known as "*kumri* † in Satara and the Southern Maratha "country. It is practised only in the villages on the "extreme Ghátmátha, and in these villages only "under certain definite and clearly recognized conditions. These conditions are :—First, land covered "with jungle. Big jungle is not required. Ordinary "scrub or even a thick growth of the karva reed is "sufficient. Secondly, land on a slope is required "both for facility of burning the brush-wood etc., "when cut and lying on the ground, and of drainage "of the heavy rain-fall of these regions. Thirdly, "a situation more or less sheltered is necessary. "If a crop is grown in a position exposed to the fall "of the South-West monsoon, the chances are that "it will either rot or be washed away altogether. "When these conditions co-exist, *dalhi* can be "carried on successfully. A slope is cleared, the "jungle felled, and, in May when the wood is "thoroughly dried, it is burnt. The ground is "thus covered with wood-ash, and in this [generally "mixed with the soil by digging with a *kudal* (pick)] "the seed of *nachni* is sown after the first burst "of rain. In some places both *nachni* and *varai* "(a still coarser grain than even *nachni*) are sown in "separate patches and no crop is grown on the land "in the second year. Further south however it is "the invariable custom to grow *nachni* alone the "first year and a crop of *varai* the second, while in "especially favoured situations a third and a fourth "crop of *ghoti* (a very coarse grain) and *karla* (oil-"seed) are raised from the same land. When this "has been done, whether one crop or more have "been raised, the land must be fallow for a certain "period till it has again become covered with vege-"tation, when the process above described is re-"peated. The necessary period of fallow varies "of course in different situations, but average "*dalhi* land will after having been cultivated for "two years, recover itself in seven or eight. Rab "cultivation is utterly different etc."

* 'Dalhi.'—A parcel or patch of ground, especially of land on the steep slope of a hill.

† 'Kumri.'—The region (especially as of lean and poor soil) along the base of little hills.—Molesworth and Candy's Dictionary.

This process differs from rab in that it is more circumscribed in its conditions and is only followed in the case of hill crops. It is apparently a simple method of fertilizing the lean and poor soils. It may be that a further study of *dalhi* may prove that it has other properties. It appears to me probable that rab is an improved variety of *kumri*. Instead of wastefully burning down the whole area of cultivation and instead of destroying (to use a bold metaphor) the goose that lays the golden egg, rab confines itself to the seed-bed and leaves the trees, lopped it is true, but more or less uninjured—some say more or less stimulated to stronger and better growth—to supply the combustible materials year by year. The principal objection to this pure conjecture is that rab appears to have extended from the rice to the uplands and not *vice versa*. At any rate rab claims a more defensible scientific basis. *Dalhi* resembles rab in one aspect *viz.*, that the rotation pursued on hill-lands in both systems is the same.

It is highly probable that there are other analogous systems in other parts of India and I look forward to receiving intimation thereof through the medium of this journal. Every variation in practice, if fully explained, will add light to the subject.

II.—Out of India.

The process of paring and burning in England merits consideration in this place, chiefly because its

chemistry has been studied; and there are several points connected with rab which may be fairly illustrated thereby.

One of the objects of paring and burning is to convert old grass land into arable land. Thin slices of the turf are cut by the paring plough and these are heaped at short distances and fired, after they have well dried. No material beyond the vegetable matter contained in the old sward is required. The ashes are spread and ploughed in. By this means an excess of vegetable matter is got rid of.

But the burning of the soil of arable land is also practised. It is adopted for three distinct purposes. It is used, as in the case of converting old pasture into arable land, for the purpose of destroying an excess of vegetable matter in the soil, being however then confined to comparatively limited districts, those of fens and bogs. It is adopted secondly for the purpose of bringing a turf quickly into tilth, and there, its object is not so much to dissipate vegetable matter as merely to destroy the fibrous texture, charring rather than burning being thus the object aimed at. It is employed thirdly, and with this aspect it appears to come into greatest affinity to rab, for the purpose of exposing clays and calcareous soils to just such heat as shall produce certain mechanical and chemical effects that are desired. I will now quote directly from three standard works, the ascertained effects of this scorching of the upper surface of clay lands.

(1).—Morton's Calendar p. 185.

The most important practice under this head is "that of burning clay, and especially I would say "calcareous clay, as a piece of periodical management in arable culture. Dr. Völkar attributes "its fertilizing influences to the chemical as well "as to the mechanical results which it effects and "the failures of the practice are in like manner "due to injuries under both of these heads. Clays "may be burnt, so as to very considerably loosen "their texture, render them more friable and easily "reduced to tilth; or they may be burnt till they "are literally bricks They may be burnt till they "shall furnish a smaller quantity of soluble matter, "than they did in their natural state to the influ- "ence of the rain: or they may be burnt at a lower "temperature, and it will be found that they have "thus become capable of yielding to the water pas- "sing through them much larger quantities of so- "luble matters, chiefly alkaline substances, especi- "ally useful for crops (and I may add for rice), "which contain them in large quantity.

(2).—The Chemistry of the Farm p. 22.

"Burning is occasionally resorted to as a "means of increasing the available plant-food, and "improving the texture of a heavy soil. The soil "is burnt in heaps which are then spread over the "land. If the soil contains limestone it is very "easy to see that the phosphates of the limestone "may become more available by the complete "disintegration which attends the conversion into "lime. The lime will also attack the silicates of "soil at a high temperature and liberate a part of "the potash from its insoluble combinations. To "produce the best results, it is essential that the "burning should take place at a low temperature. "This treatment by burning is an extreme one, "and can be recommended in only a few cases. "It must always be attended with an entire loss "of nitrogen in the soil burnt."

(3).—The Soil of the Farm p. 51., on Paring and Burning. "It liberates plant-food from the minerals "of the soil. It purifies, sweetens, and cleanses "the soil, breaking up and driving out injurious "acids destroying grubs and parasites of various "kinds which prey upon both crops and cattle and "killing the seeds and roots of weeds, and it "improves the mechanical texture of clay soils."

The first point for notice is that the use of material other than that contained in the soil is absent; but it appears very reasonable to presume that the ryots' practice of spreading combustible material over the surface of the seedbed has many of the mechanical and chemical effects above noticed. In reaping rice a great deal of the grain falls. This lying in the upper surface of the soil will germinate with the commencement of the succeeding rains. I have seen many fields so thickly covered as to give the appearance that the land had been fully sown. These seedlings are useless for transplantation. They must be destroyed. In the area outside the seed-bed, they are destroyed by the ploughings described in Mr. Day's report. In the seed-bed owing to the necessity of the early sowing, they must be *prevented*. They are verily weeds. The scorching of the upper surface is effectual in destroying the seeds. They cannot germinate, for their vitality is gone, if they are not completely burnt.

The same effect must take place on the seeds of weeds which grow up after the rice is reaped. These weeds ripen and shed their seed. The scorching prevents them giving trouble among the young seedlings. In many fields I have this year seen this effect fully shown. In seed-beds which were not rabed, the weeds are numerous; where rab has been practised there are none.

I may incidentally notice that as far as I have seen, the area of the seed-bed is rabed without any

attempt to plough it up before the material is spread. This may be a sound practice. The fallen seeds of the former crop and of weeds are not buried, but are left on the surface to the full force of the burning. It is true that this practice is not universal.

By paring and burning a fine-tilth is secured. This is also the effect of careful rabing.

Again both practices must do immense good in destroying the grubs and parasites which may come within the influence of the burning. Lastly the plant-food of the soil is not only rendered available to the plant in a much higher degree than would otherwise be possible; but the burning of cowdung or brushwood affords directly a considerable supply of just the very kind of food, which is most wanted for the early stages of the growing plant. This is the manurial aspect of rab. It is of course a very important one but it is not characteristic. If cowdung were required only as a manure, it appears, unaccountable that it should be burnt. Cowdung is not a quick acting manure, but it has a very valuable constituent *viz.*, nitrogen, which is lost by the burning, and nitrogen is of immense value to rice in common with all cereals. With brushwood, grass leaves etc., the case is different. Burning is necessary even if only the manurial value is taken into account, for otherwise the manurial constituents would not be available.

I have just read a letter in the Bombay Gazette (14 July) signed by Mr. S. Cooke, Professor of Chemistry in the College of Science, Poona, in which he advocates the use of an easily transportable manure to solve the problem of prevention of njury to Forest Conservancy now attributable to the use of brushwood for rab. This suggestion appears based on the notion which I think will be proved erroneous, that the manurial value is the only value of rab. Mr. Cooke calls rice the most "*ashy*" of all cereals. Rice in husk, of course shows a large percentage of ash. But husked rice leaves a smaller residue of ash on combustion than any other cereal of which I have an analysis at hand, and the comparison must clearly be made either between the clean grains of cereals or the grain plus the coverings of the seed.

[to be continued.]

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Director of Agriculture,

Bombay.

A NEED FOR

AGRICULTURAL EDUCATION IN INDIA.

It is not a little surprising to find that in a country like India which is almost exclusively agricultural, there should be so little attention paid both by the people and the State to the subject of Agricultural Education. According to a statistics collected by the Famine Commission, it appears that in British India out of a total population of 190 millions, 56 per cent. or 106 millions are purely agricultural, and 34 per cent. or 64 millions though classed as traders and labourers are either mostly employed on land or have small holdings of their own. Virtually then agriculture is the mainstay of about 90 per cent. of the total population of British India. Is it not therefore strange that there should be no organization whatsoever for the diffusion of agricultural knowledge among all classes of people of India, where agriculture is of such vital importance and takes the foremost place in the rural economy of the country? Even such advanced countries as Germany, France, Belgium and England where agriculture is comparatively of subsidiary importance and where the proportion of people depending on agriculture alone is very small, have found it necessary to support at considerable expense to their respective States large numbers of Agricultural Institutions of different grades. For instance in North Germany alone, there are no less than thirteen Agricultural Colleges or Institutes connected with the local Universities, of which the Royal Agricultural High School in Berlin alone costs the State £ 100 per pupil, or, taking an average of 70 students, the total sum of £ 7000, per annum. The Agricultural Academy of Hohenheim at Würtemberg which is far from being an expensive institution of its kind has a similar State grant which exceeds £ 5,000 per annum. These however are Institutions where the arrangements are for imparting higher Agricultural Education.

For intermediate Agricultural Education, in Prussia alone there are sixteen schools with 1663 pupils and a State subsidy of £ 15,479 per annum. Similarly for lower Agricultural Education, there are altogether 32 farming Schools in the Kingdom of Prussia and three more in Saxony. The State subvention to the thirteen provinces in which these schools are distributed is £ 6,698, 10*s*. and provincial grants £ 10,376. 11*s*. 6*d*. Besides these there are Agricultural Societies and Control or Experimental Stations distributed all over the country. In Prussia there are again

27 central Stations and 1710 Agricultural Societies of which 4 are provincial, 37 central, 1271 branch, and 398 independent. These 27 central stations are subsidised by the Government to the amount of £6528 and receive a further provincial grant of £3345 annually. They employ about 70 skilled agricultural chemists and a considerable number of Botanists in the interest of the cultivators of the soil, whereas in whole India it would be difficult to enumerate a couple of qualified men who find sufficient encouragement to devote their time to these branches of applied science.

Moreover in addition to these regular agricultural institutions there are vast numbers of what may be called improvement schools where instruction is intermittent, being given in winter or in evenings only. The outlay at such schools is considerable and is partly met from the fees paid by the pupils but mostly from the funds of the provincial administration, from the Ministry of Agriculture, and from local agricultural societies. Travelling lecturers are also engaged during the summer months to give instruction in theoretical agriculture and are paid generally by the provincial agricultural societies, and are under the control of these associations. It would not be right in this enumeration entirely to omit the various dairy, shoeing and house-keeping schools, more or less of a special nature, but in some sense connected with the education of the future cultivators of the soil.

In France there are 4 institutions for imparting higher, 9 for intermediate, and 23 farm schools for lower agricultural education. Besides these there are 2 shepherds' schools, 1 school of horticulture at Versailles, 4 small schools of horticulture, 23 *agronomique stations* or Government laboratories and 53 departmental professors of agriculture.

Of the 4 academies which impart higher agricultural education, the *Institute National Agronomique* takes the first place. The State grant to this institution is no less than £10,778, and leaving out of account the fees paid by students, the education of the pupils entails a cost to the State of fully 100 guineas per head per annum. Every year the students who stand at the head of those who have passed their final examination for diploma, may receive at the cost of the State a travelling scholarship tenable for three years either in France or foreign countries. A thousand pound is thus spent in an admirable way. Similarly the school at Grignon which like other schools of the same nature in France is maintained entirely at the cost of the State has a State grant of £15,600 per annum. Intermediate agricultural education which is given in 9 practical schools of agriculture costs the State about £ 31 per head per annum. The farm schools for imparting lower agricultural education is peculiar in one way. The pupils not only receive a fair amount of scientific and general instruction but are also trained in the farm work entirely free of cost. The pupils are in fact apprentices and are so styled. The allowance made by the State towards meeting the expenses of these 27 schools, is in the following rate :—£10, 16s. towards the keep of each apprentice and £236 to £296 towards the salaries of the director and staff of each school. At the end of the year 1883, the total number of pupils in the intermediate practical schools of agriculture, lower farm schools, two shepherds' schools and one school of horticulture was 738 and the total cost to the State £ 22,960. The institution of departmental professors is an important element in the agricultural education of France, which has only recently become of much importance. The salaries of these professors which vary from £ 120 to £ 130 each are paid by the State and the travelling expense by their own department. The total subvention to these professors in 1883 was £6600.

One of the most interesting and important feature in the system of agricultural education in France is the attempt which has lately been made to bring agricultural instruction within the reach of children in elementary schools. "The teaching in the boys' and girls' schools is necessarily dissimilar : whilst the former are taught about soils, manures, crops plants, machines, cattle and farm products, the girls are instructed in the employments and occupations specially within the province of a woman in a farm house, in such matters, for instance, as baking ; the management of the dairy in all its details ; feeding, milking, fattening, even common diseases of cattle ; management of pigs and poultry especially the latter, and finally the uses of kitchen garden together with the cultivation of the best kinds of vegetables and fruits for domestic purposes. This branch of the French system of agricultural education is specially interesting, because it is the only example as far as we know of an attempt in Europe to give technical instruction in matters pertaining to the cultivation of the soil to the lowest stratum of those who depend on that industry for their livelihood.

In this respect France is distinctly ahead of any country in the world, which, if not the sole cause, is no doubt one of the causes of the ease and comfort of the peasantry of the country.

In these schools prevails the system of payment by results to the teachers and not to the pupils as a means of encouragement to technical instruc-

tion. Rewards are given to the teachers by the "Society of Agriculture of France," in the shape of gold, silver, and bronze medals.

Of the *Stations Agronomique* or Government laboratories, there are 23 in France and the Government grant shows that a sum of about £150 per annum is advanced to each of them by the Agricultural Department. Besides there are three veterinary schools which cost the State £ 39,344.

In Denmark which is by no means very much advanced in agricultural education and which possesses a population of only about 2 millions, has not neglected the matter and indeed no less than £11,000 are annually devoted to this object by the State. The most important agricultural institution in Denmark is the Government establishment of the Royal Veterinary and Agricultural College which is maintained entirely by the State at a cost of about £ 7000 a year. Even Belgium and Netherlands where agricultural education has by no means attained the importance which has been given to it by the other continental States, have by no means been slow to appreciate the usefulness of agricultural education. State agricultural institutes have been established in both the countries; there are two high schools of agriculture, one at Gembloux in Belgium and the other at Wageningen in Holland. The cost of the former to the State is £4426 or about £ 60 per head per annum, and that of the latter £ 5,38. There is also a school of Veterinary medicine at Cureghena which entails a cost to the State of £ 6,000 and a Veterinary school at Utrecht entirely supported by the State at a total expense of from £5000 to £6000 a year. Like other Continental States, Belgium and Netherlands have also agricultural Societies and agricutural Stations.

As to the United Kingdom we need not repeat here what has already been told under the head of "Agricultural Improvement." We might only add that Ireland is one of the few countries in Europe where agricultural education in connection with primary schools has long been in existence.

This short review of the nature of and the State subvention towords agricultural education in North Germany or Prussia, France, Denmark, Belgium and Netherlands, shows that while the Government of these countries which have only a total population of about 70 millions spend annually for agricultural education a sum over 2 million pounds, the Government of British India which has a total population of over 190 millions spends almost nothing for the same purpose. Be it remembered that in the European countries named above, agriculture is in a very advanced state, that the percentage of agricultural population is low and that agriculture is only one of the various industries pursued and holds a subsidiary place amongst them; whereas in India agriculture is in a very backward condition, and almost the sole occupation of the agricultural class which forms nearly 90 per cent. if not more of the total population. If any country needs agricultural education and that most badly, India does; and although the British Government has lately turned its attention towords the important question of agricultural improvement, little or nothing has been done for educating the children of the soil in that branch of knowledge which is almost the only means of securing their livelihood. In this as in every other matter, the people of India look up to Government to lead them and they are never slow to follow the lead.

AUSTRALIAN WATTLES.

AN INDIAN POSSIBILITY.

It is not long, since the planting craze throughout India was "*divi divi*" as a source of tannin destined to bring wealth to some and benefit to many, by creating a planting industry which it was asserted would meet a world wide demand. Time, however, has nullified these expectations, and now the question often asked is "what has become of the *divi divi.*" This negative result has been simply induced by exaggeration, which did harm by raising hopes through promises purely speculative and outside the domain of the feasible and practicable. There can be no doubt that there are various parts of India well adapted by nature for the production of this variety of the botanical family called "Coriaria" and the pity is that they have not been utilised for the production of a commercial substance of great value in the arts, commanding a high price everywhere as tannin matter. Had *divi divi* received three or four years back the attention it needed for development as planting industry, with remunerative aspects, the Australian Colonists would not at the present period be going in for the cultivation of wattles for bark which likewise, yield the same material as the *divi divi* pods, and for which, owing to the falling off in the supply of tannin barks, there is a brisk demand in the markets of Europe. It is stated on good authority that the Australian wattle yields the best material in the world for the purposes of the tanner. The trees known as "wattles" in Australia are indigenous species of *acacia*, and it is only since past

improvidence in regard to this natural product has commenced to tell unfavourably upon the present supply that attention has been devoted to the physical predilections of the plants with a view of cultivating them on a commercial scale. We learn from a Government Report issued under the auspices of the Executive of South Australia—which is the principal habitat of the wattle—that two species are available for cultivation, and that outlay in this direction would give a return far in excess of that which is realized in ordinary industrial channels. The first of these—*Acacia pycnantha*—commonly known as the broad leaf or golden wattle, is the best of the many varieties. It is hardy and quick-growing, flourishing in localities where the rainfall averages 15 inches per annum. According to the South Australian Official Report—due to Mr. T. E. Brown, the Conservator of Forests—"this species will grow readily in almost all kinds of soils, but its rate of growth is most rapid in those of a sandy character, while at the same time the largest trees and the best bark is produced on sites where the soil is sandy on top and of a good retentive clay in the sub-soil. Mr. Brown adds, that "with this tree we have the means of making our poorest soils yield valuable crops, instead of their lying idle and worthless." For of all the *Acacias* the bark from this variety yields the largest percentage of tannic acid. The other of the two species referred to *Acacia decurrens*, called the Black Wattle, "delights in sandy soil with clay sub-soil; but it attains its largest dimensions upon a black alluvial soil of great depth, and where there is great percolation of moisture." It will even grow in situations where the soil is almost pure sand. The cultivation of this variety can, however, only be recommended in more moist and temperate regions than those which favor the growth of the broad leaf or golden wattle. In other words, it will not grow satisfactorily and as a payable crop in places when the rainfall is below 15 inches annually. This variety is not so rich in tannin as the broad-leaf wattle, yet it is three times more valuable as a tanning agent than English oak bark. These two species of the Australian wattle, therefore, offer the best recommendations for Indian cultivation. The broad-leaf wattle only attains a height of 25 feet and 12 inches in diameter, whereas, the black wattle grows to a height of 40 or 50 feet and to diameter of 20 inches. The latter is therefore sooner available for stripping, which, in either case, should not be attempted before the expiration of seven years from seeding. The bark now sells at £87 per ton; and, since 10 lbs. of bark is the lowest yield per tree, and 1,000 trees may be easily planted to the acre, the profits derivable from wattle cultivation are therefore found to be highly remunerative. We have no doubt that wattles might be profitably cultivated in India. Considering the vast extent of wasteland suitable for the purpose in the country and the facilities it affords generally for this class of industry, the possible becomes very probable that not only the European planter but the Indian ryot would find this a good field for investment.

NEWS.

The quantity of tea exported from China and Japan to Great Britain from the commencement of the season to the 2nd of July was 49,170,477 lbs., as against 49,257,920, lbs. exported in the corresponding period of last year. The exports to the United States and Canada during the same period were 6,790,905, lbs. as against 7,654,678 lbs.

Trade in Australia during the month of June does not show much signs of improvement; and as and as regards the exports from Melbourne, the returns would have been much more unfavourable, but for the large shipments of gold. As it is when compared with June 1884, the exports show a decrease of £ 192,567 and the imports a decrease of £65,240.

The total receipts from the four sales of Bengal opium and four months' duty on opium exported from Bombay were Rs 2,77,35,105, which was Rs 5,85,105 better than the estimate. The receipts from Bengal opium were for the first time for some years worse than the estimate by Rs 4,32,095, whilst those from Bombay were Rs 10,17,200 above the estimate. The great deficiency in the Bengal receipts occurred at the July sale, when they were no less than Rs 1,17,045 below the estimate.

The total exports of tea from Calcutta from the 1st of May to the 31st of July amount to 9,962,193lbs., the quantity for the two preceding years being 7,516,488 lbs., and ,3647,792 lbs., respectively. In July, as compared with those of July, 1884, the exports to England showed an increase of 178,883 lbs., while those to Australia advanced 7,280 lbs., and those to America, 2,213 lbs. The improvement has extended to the Ceylon trade, which has advanced to the extent of nearly two million pounds in the past three years.

Messrs. William Moran & Co's Market Report states that since their last issue the weather in Behar has generally been favourable. Accounts from the different factories vary considerably, and although as a rule vat produce is fairly good, the plant is cutting out very badly, and biggah produce is poor. Of the three districts, Chumparun is the most advanced, but will not, they think, do as well from first cuttings as last year, and Tirhoot and Chuprah are both decidedly behind last year, and will, they fear, make a good deal less. *Moorhun Mahai* will close towards the end of this month, and the season is so late that there is not much chance of a good

return from *Khoontees*. Accounts from Lower Bengal are indifferent. Jessore, Kishnaghur, and Midnapore have had too much rain, and fine sunny weather is badly wanted to bring on the plant. Moorshidabad is doing fairly well, and produce has been good. In Benares manufacture is just commencing; some parts of the district have had too much rain, and the area under cultivation is less than last year. From the North-West they hear of considerable damage having been done by the late heavy rain and floods, especially in the Allyghur and Bolundshahur districts, and the outturn will be less than was anticipated.

It is proposed to start a limited liability company in London, to be called the "British Burma Lead Company." Although the present price of pig lead is unprecedentedly low, being only about £11 per ton, whereas for many years past the price has ruled from £18 to £23 per ton, it is said that pig lead could be sold in Burma at a profit, even if the price were to fall to half the present rate. It is thought the company would secure the monopoly of India, China and Japan.

The Indian wheat trade has shown signs of improvement this year, so far as the quantity exported goes. During the first quarter of the current year, nearly 204 lakhs worth of wheat was exported; against less than 157¾ lakhs during the same months of 1885. The exports to the United Kingdom show an increase of over 56 lakhs. The exports to France and Egypt fell off; but there was a large increase in the exports to Belgium, Holland and Italy. The exports of Indian tea show a considerable increase. Over 30 lakhs worth of tea was exported, during the quarter, to the United Kingdom; against less than 16 lakhs worth in the same quarter of last year.

A Kumaon letter, dated the 10th instant, says that the rainfall since the beginning of the month had been unusually heavy for August, bringing the total fall this season up to 33 inches. The rice crop was good, but millet and bhut, a species of pulse, were failures. Tea making was actively progressing, but it was not expected that more than 100,000 lbs. of green tea, if so much, would be made for the Central Asia market, the uncertainty of our relations with Russia having alarmed the native merchants. A good deal of tea made in the district is now sent to the Kothgodan station of the Rohilkand and Kumaon Railway, instead of by the old circuitous route *viâ* Almorah or Ranikhet to Moradabad, a great saving in transit charges being thus effected.

The latest papers from Mauritius estimate that not only will the sugar crop this season prove a short one, but that the outturn will be inferior to that of the last crop. This is partly due to the long drought which was experienced at the beginning of the year, and now the cool season has commenced and has checked the growth of the canes.

The council of the Society of arts have awarded the Society's silver medal to Mr. E. C. Buck for his paper on "The Agricultural Resources of India," which was read by him during the past session.

There appears to be something like a scarcity in the Garo hills. A correspondent of the Englishman writing from Tura says that rice is selling there at four or five seers per rupee, and that the small stock in the bazar must in a few days be exhausted.

Government have sanctioned the proposal of the Commissioner of Salt and Abkari Revenue to collect the interest on the capital cost of the permanent works in excise salt factories in lump sum or in fixed instalments instead of in the shape of a cess on each maund of salt sold, where the former course is preferred by the licensees.

A French firm at Singapur have succeeded in manufacturing brandy out of pine-apples. The liquor is said to be very good, and a sample shipment will soon be sent to England for the opinion of experts.

The professional cattle poisoner has just been at work on an unusually extensive scale at Rawal Pindi. During the past month the mortality among cows and bullocks there has been excessive, some two hundred valuable animals having died. It was suspected that poison had been given them, and a *post morten* examination made by Surgeon-Major Walker of two cows which had died suddenly revealed traces of poison in the stomachs of both. This discovery has caused much excitement, and a considerable sum has been subscribed in order to bring the guilty party to justice. A contractor for removing dead animals from the cantonments, who was allowed to retain the hides, besides being paid for his trouble, is strongly suspected of having instigated the mischief in order to increase his profits.

The exports of wheat and oilseeds for the three months ending the 30th of June show a considerable advance upon those of last year, especially at Bombay. Even in Bengal there was an advance in wheat from 1,119,975 cwts. to 1,476,674 cwts. In Bombay the increase amounted to nearly a million cwts., and there was a similar advance in oilseeds. The wheat exports from Sind have increased from 499,346 cwts. to 1917,686 cwt., for the first three months of the financial year.

After ten unsuccessful attempts to convey Scotch salmon ova to Australia, and New Zealand, a new method has been tried which has been entirely successful. Upwards of 200 000 ova were captured last December from the Tweed at Peebles, and more than half of these have now been landed alive at Wellington.

The total capital outlay on irrigation works in Sind up to the end of the year 1883-84

Rs. 1,01,13,681, of which Rs. 67,74,709 had been spent on productive works. The actual revenue from all sources was Rs 28,10,861, whilst the expenses for maintenance and collection amounted to Rs. 14,07,958. On the canals which are classed as productive, the earnings give a percentage of 4·60 on the capital invested, whilst the return from those works for which capital and revenue accounts are kept was, according to the figures, 1·06 per cent. The area cultivated by the aid of irrigation works was 1,540,831 acres, the revenue from which was Rs. 31,68,358, or nearly Rs 2·33 per acre. Even this rate is expected to increase, as the people are beginning better to appreciate the benefit of the canals.

The English Boarad of Trade returns continue their discouraging tale. The total value of the imports for June was £29,546,984 against £ 29,053,651 in June last year; but this is entirely attributable to the import of wheat, being 7,064,000 cwt. against 2,886,000 cwt. in June 1884, all the other figures being reductions. The total value of the imports for the first six months of the year was £192,447,401 against £198,981,141 for the same period last year—a decrease of £6,633,740. The total value of the exports of British and Irish produce and manufactures in June was £17,717,289 against £18,649,174 in June last year—a decrease of £931,885. The value of exports of British and Irish produce and manufactures for the first six months of the year was £104,398,088 against £115,621,173 in the same period last year, or a decrease of £11 223,085.

The Governor of Bombay opened the recently-appointed Forest Commission at Poona on Thursday last, after which the Commission will reassemble to commence business at Tanna.

A numerous deputation of village agriculturists have arrived at Puna to lay their grievances under the Forest laws before Lord Reay.

Bengal Opium, though it continues to sell considerably under the estimate, did not fetch such extremely bad prices as it did in previous months. To the end of July, the balance on the right side amounted to Rs 5,85,105. Bengal Opium sales in July 1885, realized Rs 50,90,455, and Bombay Rs. 22,21,250. The total revenue realized from opium for the year up to the end of July amounted to Rs. 2,77,35,105, it had been estimated to realize Rs. 2,71,50,000. From the first the Bengal Sales have been very bad, causing a loss on the estimate of altogether Rs. 4,32,095.

An influential public meeting of the chief residents of the Hughli district was held at Chinsurah on the 16th instant to consider the advisability of holding an exhibition of agricultural produce and implements next cold weather.

According to an official report just issued on large industries in Madras Presidency, there are 2 Timber Mills, 16 Coffee works, 36 Cotton Presses and Cotton Weaving Establishments (other than Mills), 1 Oil Mill, 4 Sugar Mills, 1 Flour Mill, 3 Iron and Brass Foundries, 29 Tanneries, and 1 Cement Manufactory. These establishments give employment to about 15,000 persons every day. Most of these industries are maintained by European capitalists.

The Sind Arts College promises soon to become an accomplished fact. Four city municipalities have consented to budget for Rs. 10,500 a year, as their contribution towards its maintenance, and several other municipalities as well as district boards have promised handsome donations. The Thakore Sahib of Bhaunagar has subscribed Rs. 5,000 to the College Fund, being the first native Prince to do so, and the private subscriptions now amount to Rs. 55,000, which the promoters have promised to increase to Rs 75,000.

EXTRACT.

The Cultivation of the Ground-nut.

BY

*Mr. K. Krishnamachariar of Anantapur.

Ground-nut as an oil yielding plant seems to have been long known in India, though its original home is universally believed to be South America, from whence it was transported to Britain in 1712. When and by whom was this plant introduced into this country is not exactly known. It is extensively cultivated in South India and in some parts of Bengal and Upper India. The first recorded export of ground-nut oil from this Presidency was in 1848 and 49. Since then, it has become gradually an article of great commercial importance, so much so, as to interfere with the French trade in olive oil.

It is cultivated for the sake of the oil which the seeds yield on expression. The oil is used for pharmaceutical purposes, also for lamps, and for lubricating machinery. It is used in the manufacture of soap and in the preparation of sweetmeats. The cake is a very valuable food for live stock and an excellent manure when applied to the soil. The husk, though hard and woody, forms a good manure when well decomposed. The plant also ranks as a valuable fodder herb as it furnishes much nutritious haulm for forage.

Arachis hypogéa is particularly remarkable from the manner in which the fruit is produced. The young fruit, instead of being placed at the bottom of the calyx, as in other kinds of pulse, is formed at the bottom and in the inside of a long slender tube which looks like a flower-stalk. At the same time, the stalk of the fruit lengthens, until the point strikes the earth into which the now halfgrown fruit

is speedily forced and where it finally ripens. When mature, it is a pale yellow wrinkled oblong pod often contracted in the middle. The plant possesses a long tap root which extends deep into the earth, drawing thence the nutriment which is beyond the reach of many of our cultivated crops. The plant is an annual, as it passes through all the phases of its existence in one year and it is a lime-feeder.

In this Presidency, the total area under ground-nut cultivation is 73,568 acres of which in South Arcot 48,220, Tanjore 8,649, Chingelput 7,876, Trichinopoly 5,766, Salem 1,288, North Arcot 1,249, Coimbatore 470 and Godavery 20 acres are cultivated.

A light loose calcareous soil is best fitted for its growth. It thrives well on sandy soils containing a fair amount of phosphates of lime, potash and magnesia. The outturn of nut and the percentage of kernels and oil are great when the plants are grown on light loose reddish loams. Very stiff clays and soils containing much saline matters are not well adapted for its growth. The crop has a very strong aversion for stagnant water, therefore it will not grow on land which is always wet or on which water is likely to stagnate.

About the month of June or even earlier if there be a shower of rain, the land is freely ploughed twice or thrice and all the weeds are extirpated. Until the time of sowing the seed, the soil is every now and then stirred so as to expose every particle of it to the beneficial action of the atmosphere.

When the land is ploughed and a perfect state of tilth is obtained, it is liberally manured by penning flocks of sheep at an average of 400 to 500 head per acre or by the application of 20 to 30 cart loads of well decomposed farm-yard manure.

The first method is decidely a better one; for both dung and urine may be utilized; but they are not secured, for most of the volatile ingredients contained in them are lost by exposure to sun and wind, leaving for the use of plants only a very small quantity of valuable mineral matters.

As a rule in preserving ground-nut for seed much care is taken. Heavy and good looking pods are selected and dried in the sun for about 4 or 5 days. Sometimes the pods are exposed to the action of dew in the night, next morning they are dried in the sun as usual. This is done, they say, in order to protect the seeds from being attacked by insects. The pods are then put in pots with some ashes and a thin layer of straw at the top, and the pots are then closed with cow-dung.

A day previous to sowing, the pods are decorticated by hand. It must be remembered that if the pods are shelled or husked either by being trodden or by being beaten with a stick, as is generally done for expressing the oil, the embryo between the cotyledons is loosened or otherwise injured and consequently the percentage of vital seed is remarkably diminished. Seeds, as a rule, germinate better when sown within 2 days after being decorticated. And if kept mixed with husk in an open basket they are fit to be sown 4 days after separation. Blanched seeds or seeds whose thin brownish colored covering is removed, never germinate.

About 30 to 40 Madras measures of seed are necessary for sowing an acre. Under favourable circumstances and careful management a less quantity may be sufficient.

In July, or, if there be no rain in that month, after the first shower in August, the field is ploughed twice in the morning, and in the after-part of the day the seed is generally sown.

On poor soils the seed must be sown thickly. On rich soils they must be sown thinly. More seed is required if the crop is sown late in the season.

The mode of sowing the ground-nut may seem to be very peculiar. A man with a pair of bullocks and a plough goes on opening staight furrows; and 3 men, or 4 men, with sacks of seed around their waist follow the plough and drop the seeds 5 to 6 inches apart. When the ploughman opens the second furrow, the soil raised by the plough partly covers the seeds in the first furrow; thus the soil from each subsequent furrow covers the seeds in the previous one. After the whole field is thus sown a heavy levelling plank is dragged over it for the double purpose of consolidating the loose earth and of covering wholly the seed sown. The field is then squared into beds of 6′×6′ so as to facilitate the subsequent irrigation in case the periodical rains disappoint. Undecorticated pods are rarely sown. In this case more moisture and longer time are required for the seeds in the hard woody shells to germinate. Another difficulty is as there may be more than one seed in a pod it must be broken before it is dropped into the furrow. Transplanting is not practised here.

If too much moisture be present in the soil when the seed is sown, a hard incrustation will be formed by evaporation which effectually prevents the young plants from shooting upwards. Another evil effect of over-supply of moisture is the rotting of the seeds under ground. If too little of it be present in the soil the seeds would not germinate for want of sufficient moisture. Sound common sense and good practical experience are necessary to guard against such faults.

During the daytime for about 3 or 4 days, after the seed is sown, crows begin to pick them up from within the soil. To prevent this a long post is fixed in the centre of the field. To the other end of it

is suspended a dead crow or at least its wing and feathers. Jackals do more harm during the night, they may be prevented by watching the fields till the seeds begin to germinate.

The time which the seeds take to germinate depends upon the nature of the soil and the condition of the weather. On the 4th day after sowing, some plants may be seen coming through. By the end of a week the whole field will be covered with the young plants. If for want of moisture the young shoots strive in vain to come through, you may safely irrigate the field. The next day the young plants will all shoot upwards.

When the plants are 3 or 4 weeks old, they attain to a height of 4 to 6 inches. The field is then hand-hoed for the first time and the plants if overcrowded are thinned out.

As the ground-nut pods are borne under ground, a ground outturn will depend on the lateral branching of the plants over the soil: but if the plants are too near each other they will grow straight up with but few side branches. Moreover when the plants are overcrowded they will prevent the free circulation of air between them and consequently the plants will suffer from *rot*, a disease in which the lower brahches begin to decompose.

When the plants begin to flower and the small tubules which are to be the future seed pods elongate, growing downwards to penetrate the soil the crop is handhoed a second time.

As a rule for about a month from the date of sowing, no watering is necessary; after that period unless the monsoon rains help the cultivator, the ground-nut fields require to be watered once a week during dry weather and fortnightly if the season be fair.

Excess of rain or water turns the plants pale and weak, the fields when frequently flooded yield slender and weak nuts (pods) which are often empty containing no seeds in them.

In about 6 to 7 months the growth of plants ceases and they begin to wither. Dig up some pods and if they are hard, break readily with brittleness and the kernels inside have a reddish brown covering, it is certain that the crop is sufficiently matured. Withhold watering and allow the plants to dry.

A portion of the field is moistened in the evening and the plants are pulled off next morning. The soil is loosened with a small pick and the pods are collected.

The vines of the ground-nut plants are dried and stacked. This hay is considered to increase the secretion of milk in cows.

Wages to coolies who pick the pods is always paid in kind. It varies with the quantity of pods to be found in the field. If there be plenty, one part out of every six which a cooly collects forms his share; but if the yield be poor the fruit of his labor is equally divided between him and the cultivator.

The chief difficulty which the cultivator has to encounter in the cultivation of ground-nut is in securing a sufficient gang of coolies at the time of harvest notwithstanding the high wages he is prepared to pay.

In some places where water flows to the field by gravitation, the following less expensive mode of collecting the nuts is adopted. The plants are first removed and the nuts under-ground are allowed to dry thoroughly. The field is then moistened and ploughed. Water is then let in till it is 6 inches in depth. The soil is then well stirred until all clods are well disintegrated. The pods being lighter than water are easily collected.

Before harvesting, the pods are dried underground. A gentle shower of rain will make all pods sprout before a sufficient number of coolies can be gathered.

The ground-nut crop as generally cultivated in this country is considered to be a very exhausting one notwithstanding the accumulation of partly decomposed vegetable matter to a uniform depth of one to one and half inches over the whole field. Whatever may be the decrease in other constituents of the soil one thing is ascertained beyond all doubt *(viz.)* that the land is positively better stored with organic matter at the end of the period than it was before the crop was grown, while the general experience has proved in a more conclusive manner that the field subsequently planted with ragi without the least application of manure gives better results than when the crop is grown on other lands, (not previously sown with ground-nut.)

Generally the nuts are sold by the cultivator at at so much per cart load which is equal to nearly 11 Madras colums or 1,000 lbs. If there were no foreign demand the prices will be as low as Rs. 25 per cart load, and they rapidly rise to Rs. 40 if there be any.

The approximate cost of cultivating an acre of land with ground-nut :—

	Rs.	As.	P.
Ploughing 6 times at 12 annas each time	4	8	0
Manuring with 24 cart loads of manure...	6	0	0
Seed, about 35 measures ...	3	8	0
Sowing	1	4	0
Hand-hoeing twice	2	4	0
Well irrigation, 4 times ...	6	0	0
Rent	4	0	0

Wages to coolies paid in kind (half a cart load)	17	8	0
Total expenditure ...	45	0	0
Net outturn of nuts per acre about 3 cart loads	105	0	0
Two tons of straw	10	0	0
Total	155	0	0
Net profit to the cultivator ...	70	0	0

CALCUTTA MARKET REPORT

FOR THE

MONTH OF AUGUST.

Exports.

Hides.—Supplies continued small. Demand is moderate, but prices for some descriptions have advanced slightly. Native dealers generally are holding back supplies in the hope of prices rising, and under speculative influences, rates at country markets, especially for Daccas, have a decided tendency upwards.

Seeds.—The river channels are now open, and supplies of *linseed* are coming forward freely. The effect on the market is to check the tendency to enhanced prices, which would otherwise be caused by the strong demand which has been experienced during the fortnight under notice. The market for *rape seed* is dull and drooping. There are no stocks of *tilseed* or *niger* and the market for *poppy* is inanimate. There is a good supply of *castorseed* coming forward which has greatly steadied the market. Prices are weak. In the *castor oil* market prices continue low, and the market generally is dull.

Rice—Table.—A good demand has been experienced for London and the Cape, and with light stocks, prices have ranged higher. Prices are rising for *Ballum*, and in *Moonghy* dealers are holding-back. There is but little *Kazla* in the market, and no business is doing.

Wheat.—Good demand continues, and prices are somewhat higher.

Lac Dye.—No business.

Shell Lac.—Prices have a lower tendency. The only buisness done has been to cover an August—September shipment.

Safflower.—There is a little doing in this article.

Saltpetre.—A slight decline has been marked, and business is dull.

Sugar.—Nothing doing.

Turmeric.—Small transactions are reported.

Cutch.—In the absence of supplies of desirable qualities in Rangoon, dealers decline to quote.

Silk.—No stocks. The Rainy Bund is likely to be very small.

Silk Piece Goods.—Continued good demand. No change in prices.

Cotton.—Is unchanged.

Jute.—The easiness in *Loose Jute* continued for a few days but only old "loose" gave way further in price. An improved demand shortly after set in and not only was this decline recovered but a further advance established in both "old" and "new." At *Serajganj*, owing to a falling off in the arrivals, prices have steadily advanced. At the close the feeling is quieter for all except fine qualities, which are in good demand. At *Naraingunge* a steady small business has been going on at much about the same rates, the better quality reported is maintained all round. This mart is still behind-hand in regard to imports, but quality promises to be much better than last year.

Imports.

The market has relapsed into a state of extreme quiet. Heavy rains in the Panjab, North-West and Behar have quite put a stop to business there, and this has made itself apparent here—for buyers are both buying and taking delivery on a very reduced scale.

Earlier in the fortnight there was a considerable business in *prints*, chiefly for Poojah delivery, but enquiry is apparently satisfied for the present.

Dealers generally seem to anticipate a fairly active season later on, when the autumn-buying makes itself felt.

CROP AND WEATHER REPORT.

For the Week Ending 22nd July 1885.

General Remarks.—Rain is reported from the Madras Presidency generally, and prospects, which are elsewhere fair, have much improved in Bellary and are more favourable in Anantapur. More rain is still wanted for the crops in parts of Belleary, Ganjam, and Tanjore. In Mysore slight rain fell in most parts of the State, but more is required. Prospects are uncertain in Kolar and in the lowlying tracts of the Shimoga and Kadur districts; elsewhere in the Province prospects are on the whole, favourable. In Coorg there has been a good deal of rain, and prospects continue favourable.

Good rain has fallen throughout the Bombay Presidency and prospects have greatly improved. More rain is required for sowings in Khandeish and in the Panch Mahals. Kharif sowings are in general progress. Rain has fallen throughout the Berars, in Hyderabad, and the Central India and Rajputana States, and prospects are, on the whole, very favourable, though in Marwar considerable anxiety is said to prevail on account of the scanty rainfall. In the North-Western Punjab, and in the Central Provinces rain has been general, and kharif operations are in active progrgss.

Good rain continues to fall in Bengal, and agricultural prospects are favourable in all districts. The autumn crops and sugarcane promise well, except in some places, where they have been damaged by floods. Harvesting of early rice and jute has begun in parts of Northern and Eastern Bengal, and the transplanting of late rice is going on well. Good rain is reported from Assam, and the state and prospects of crops continue favourable.

In British Burma the weather is seasonable; and ploughing sowing, and transplanting are in general progress.

The public health is fairly good in most Provinces, and prices are generally stationary, except in the Punjab, where they are rising in Ferozepore and Peshawar. In Bengal prices are steady.

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1 The Proceedings of the Agri-Horticultural Society of India for the month of August. From the Deputy Secretary.

2 A Minute on the Abolition of the Government Farm at Saidapet. From the Director of Revenue Settlement and Agriculture, Madras.

3 Sugar-cane and Sugar-Trade in British Burma. From the Director of Agriculture, British Burma.

4 British Burma Gazette for September 5th, 12th and 19th. From the British Burma Government.

5 Report on the Nagpur Experimental Farm. From the Director of Agriculture, Central Provinces.

6 Questions circulated by the Chairman of the Forest Commission to selected persons. From the Director of Agriculture, Bombay.

7 Annual Report of the Royal Botanic Garden, Calcutta, for the year 1884-85. From the Bengal Government.

8 Letter of the Director of Agriculture, Bengal, to the Agricultural Officers of the Department, on the Cultivation and Trade of Wheat in India. From the Author.

9 The Indian Coal Mines. From J. Charter F. S. S.

10 Trade and Navigation Report for April, May, June, July and August 1885. From Government of India.

11 Report on the Ensilage Experiments conducted by Brigardier General Wilkinson at Fort William. From the Director of Agriculture, Bengal.

12 Correspondence on the Influence of Soil on the Color of Wheat. From the Government of India.

13 The Proceedings of the Agri-Horticultural Society of India for the month of September. From the Deputy Secretary.

The thanks of the Editor are recorded for all the above contributions.

In connection with the coming Lucknow Exhibition of Arts and Manufactures, in November next, the local paper considers it advisable for the local Committee to entertain the services of Mr. Pat. Doyle, C. E., as this is a department in which that gentleman could prove useful. Mr. Doyle would lay himself out energetically in furtherance of plans for ensuring the success of the Exhibition. His extensive acquaintance with the various industries of the Province, economical and technical, ought to be invaluable to such undertaking. These "shows" are a feature of of the "Times." The incentive they give to emulation is productive of much good, and their advantages as regards public instruction is obvious. The last great exhibition held in Lucknow was under the auspices of the Taluqdars or landed gentry of Oudh in 1882, which was chiefly agricultural in its scope and object.

In view of the report on the subject of wheat cultivation and trade in India called for submission by the Government of India by the end of next November, Mr. Finucane, the Director of Agriculture in Bengal has kindly placed at our disposal a letter written to the agricultural officers working under him. The three points discussed in the letter: (1) the necessity of obtaining clean grain for export, (2) improvement of the species of wheat grown, and (3) the question of agricultural forecasts, the encouragement of good cultivation and the communication of instruction to cultivators. The impure condition of Indian wheat as compared with

that of other countries is attributed to one or more of the three following causes :—

1st. The mixture of other grains due to the practice of growing two or more crops on the same land at the same time.

2nd. Imperfect arrangements for winnowing the grain and removal of extraneous matter.

3rd. Deliberate adulteration by traders, brokers or others.

As regards the first of the causes enumerated above, the Commissioners of Divisions following the instructions of the Bengal Government reported that little could be done in the matter of preventing the mixture and added that all that was possible would be done in making known to the cultivators the importance of keeping their wheat free from foreign substances. Attention has since been called to the circumstance that the cultivator in growing oil-seeds or other crops with wheat, selects such crops as are likely to succeed in a drought when wheat fails and thus protects himself against the risks of an unfavourable season. The mixture of oil and other seeds with wheat is surely then not a mere accident and due to the ignorance of the value of clean samples as is too often supposed, but is inherent to the system of cropping pursued in some places and also to the hand-to-mouth existence of the poor ryots who can ill-afford to risk his security from starvation for the doubtful gain of growing clean sample of wheat. In some places where leguminous seeds are sown along with wheat, there is the further advantage of securing an excellent fodder for the ryots' cattle, because the straw of the leguminous crops, getting mixed with wheat-straw, makes the latter much more nutritious and wholesome. Whether the advantages resulting from the production of clean grain will, in these instances, outweigh those resulting from more nutritious fodder and security from risk is very doubtful.

"The standard of refraction in Calcutta is 5 per cent. and it is to be remembered" pertinently remarks the Director of Agriculture, "that as 5 per cent. is ordinarily deducted, it is doubtful whether cultivators would, under existing arrangement, derive any benefit from the production of entirely clean grain, or grain in which there may be less than 5 per cent. of foreign matter." No amount of official information or distribution of handsheets to the ryots as proposed in the Punjab, or official interference of any kind however well meaning will induce the ryots to grow clean grain. They must be worked in the only way which they understand. When they will find that clean grains bring more money in their pocket, no interference from any side will be necessary. With the present standard of refraction, there is absolutely no inducement whatsoever for the cultivators to grow clean sample. But if the standard of refraction be reduced to 2 per cent. as the Director proposes or no uniform standard of refraction at all be adopted, there is greater likelihood for the ryot to be repaid for his troubles in growing cleaner sample. Then again the separation of the hard from the soft and the white from the red grains is not so easy a matter as might appear at first sight. From what has been made out from experiments conducted by the Bombay Agricultural Department (see page 11, para 4; and page 103 para 2, Indian Agricultural Gazette), it appears that the cultivators are not so much to blame for the mixture of the hard and soft and the red and white grains, but the influence of climate, season and soil have much to account for that. It has been noticed that with the change of locality, soft wheat not unfrequently turns into hard and thus admixture becomes inevitable.

With reference to the second cause of the impurity of Indian wheat, attention is directed to the "ryot's means to thrash his wheat on a wood, canvas, or matting floor and that a common fan would be far more efficacious than winnowing the grain by exposing it to the action of the wind by pouring it out of a basket or tray." The Director of Agriculture is of opinion that "if anything is to be done in the direction of introducing better arrangements for cleaning the grain by winnowing machines or otherwise, the agency through whom the attempt must be made is that of Zemindars, village headmen, or the grain-dealers themselves." On this subject also we refer our readers to the article on "Steam-threshing" which appeared in the first number of the Indian Agricultural Gazette.

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The next question to which attention is called is the improvement of the species of wheat grown. It has been ascertained from wheat merchants of Calcutta that the kinds exported from the Calcutta port are (1) No. 1 Club, (2) No. 2 Club, (3) No 3. hard red, and (4) No 4. soft red. Mr. Allen, the special officer of the Patna Division, has been requested to make careful enquiry

as to the extent No 1 Clute of Buxar, a very superior soft white wheat, is grown in Shahabad or other districts of Behar, the condition of soil and climate most favourable to its production and how far the cultivation of it might with advantage be extended to other districts. The agricultural officers of the Bengal Province hardly need any warning from us that the cultivation of transported or imported species should be tried with very great care. On this point the experience of the Khandesh Government Experimental farm will be of great value. Besides the ryot's field is hardly the place to conduct these experiments. Suspicious as he is of innovations, one failure in his field will make him doubly so and discredit in his eyes every attempt at agricultural reform. For operations like these there must be Government Experimental farms.

As regards the question of agricultural forecasts etc., we share the fear of the Lieutenant Governor that until village establishments are organized, we shall not be in a position to properly prosecute enquiries into this branch of the subject. But as the organization of village agency is a question of time, His Honor desires that in the meantime the Agricultural Department should endeavour to collect accurate knowledge on the subject and to disseminate any information which may be of practical use. The question of the improvement of cultivation and of increase in the out turn per acre by the use of artificial manure or otherwise is already engaging the attention of the agricultural officers; but for the collection of statistics of the area under cultivation and forecasts of out-turn etc., the Director of Agriculture suggests that with the co-operation and support of the district officers, an attempt might be made in that direction in one or two districts of the Patna and possibly also of the Bhagalpur Division, through the agency of existing putwaris who have already been registered in most of the Behar wheat-producing districts. We wish to see his suggestion carried out in one or two districts but we have great misgivings as to how far the proposed agency will be efficient. It is admitted that the figures showing cultivated areas in Bengal and Behar are nothing more than guesses of the district collector or his subordinates. We know that in most of these cases the village chowkidar is the unit of the collecting agency and in the proposed scheme the only change is that putwari will take the place of the village chowkidar, a change for the better no doubt, but of doubtful efficiency.

Pending the organization of village agency and cadastral survey, we have to propose the utilization in one or two districts of the Burdwan Division, or any other Division if thought proper, of the agency of the village school masters in the collection of the required statistics. The agricultural officer of the district taking along with him the Sub-Inspector and Deputy Inspector of schools of a particular thana or place will be instructed to go to the villages, explain to the village school masters in the presence of the Sub-Inspector, Deputy Inspector and the village headmen, the importance of statistical records and leave directions as to the method of collecting statistics and of filling up forms supplied by the Agricultural Department. No one will doubt that the village school matter will be a much better man than either the chowkidar or putwari to serve the purpose of the Agricultural Department, will be better able to appreciate the importance and usefulness of the subject and, what is most important, to create an interest amongst the villagers and enlist their sympathy with the scheme. The statistical forms to be filled up by the village school masters will be in the vernacular of the district, who after filling should send them to the Sub-Inspectors under whom they respectively serve who, in their turn, should after checking the returns send them to the Deputy Inspector. The Deputy Inspector will collect, collate and check the returns, transcribe them in English and send them with his remarks to the Agricultural officer of the district. The Sub-Inspectors and Deputy Inspectors will have to take little or no extra trouble for this additional work required of them, for they will be easily able to check the work of the village shcool masters during their usual inspection tour. It will involve no great expenditure on the part of the Government, since the only man who shall expect some remuneration will be the village school master. The agricultural officer of the district will visit the villages frequently and not only instruct the village school master and check his work but also try to create an independent body in each village taking an intelligent interest in the matter and helping the school master in the collection of statistics. These independent bodies will be the germ of the Village Agricultural Societies as proposed by Mr. Allen of the Bengal Agricultural Department. Even when the village agency will be organised, these independent bodies will prove to be of great service. If we are rightly informed such an attempt is being made by the N.-W. Provinces Agricultural Department.

To the letter of Mr. Finucane is attached a letter from the Under Secretary to the Government of Bengal containing an abstract of reports from the Commisioners of Divisions on the subject of wheat trade and cultivation submitted for the information of Government of India. In this abstract we find short descrptions of the nature of wheat-growing soils and out-turn of wheat per acre, which are too discordant to be of any practical value. Besides in some places we have some very curious reading which for the edification of our readers we beg leave to quote here.

"NATURE OF THE SOIL, Nudia District.—The cultivation of wheat is confined to raised lands, composed of alumina, silica and sand in proper proportion, or what is called in Bengali, doasla land ; but this district for want of alumina and for the prevalence of sand in its underbeds, is generally ill-adapted to the growth of wheat."

The sentences speak for themselves and it needs no comments of ours to show the absurdity of the description. The district officer or whoever might be the writer of this description has a very curious idea of the science of chemistry. Amateur scientists we have frequently to notice seldom fare better.

WE have repeatedly pointed out in the pages of this journal that the usual practice of the Indian ryot however unintelligent silly or foolish it may seem to the inexperienced, if probed to the bottom, is found to be the result mostly of local peculiarties and the mature experience of generations of cultivators. We have also repeatedly pointed out that the best and the only way of understanding him is not by putting direct questions to him and asking direct answers which are always misleading, but by watching his operations patiently and carefully with a view to find out the *rationale* of his practice. This has been very forcibly illustrated in the recent opposition of the Thana hill ryots to the encroachment of the Forest Department upon their long enjoyed privilege of collecting rab materials from hill-lands. It appeared to the Forest Department that the practice was only the result of gratuitous terms on which rab materials could be had and that it was utterly wasteful. The hill tribes when asked could not explain their practice but could only assert the necessity of it to the officers of the Forest Department who interpreting their inability to explain into absence of any explanation thought that there could be no better field for the extension of Forest Conservancy than the rab-growing area of the Thana ryots. Read in the light of the recent investigations it is quite plain why these ryots strenuously opposed such a policy which threatened almost to ruin them. The patient and careful investigations of Mr. Ozanne, the Bombay Director of Agriculture, have put us in possession of facts which tend to prove conclusively that the system though wasteful to a certain extent is neither unreasonable or silly as the forest officers would have us believe and that until some cheaper substitute be shown to them the rab system however wasteful must continue.

THE Madras Times of the 20th September brings unto prominence a parallel case from Madras. It appears that it is a practice in the Madras Presidency, the Nilgiris in particular, and, we believe, in many other parts of India to set fire during summer to the rough grass and scrub growing on hill sides. This fire no doubt sometimes extends to the forest and burns up the trees. The indefatigable forest conservators thinking that the cultivators set fire to grass either for fun or beauty of sight at night, or that the fire is kindled in the forests "by careless natives cooking food under a tree or kindling the fire to frighten away wild beasts, or that the careless beaters and servants of the sportsmen kindle the fire in the forest, served Mr. Barlow, late Commissioner of the Nilgiris, with a notice that a special area be enclosed in which shooting etc. is prihibited. The Forest Department did not find in Mr. Barlow, such a submissive and unobtruding character as the native Indian ryot. Out he came at once in print showing that it is neither for fun nor for beauty of sight at night but that they do it in the way of business in order to improve the next crop of grass.

THAT the growth of grass is improved by burning, he shows from his own observation as well as by the trouble the people persistently take to burn it, and by the preference given to tender grass by cattle and wild animals. The practice of burning old and rough hill grass is not unique in India. In Scotland farmers are in the habit of burning their hill-pastures periodically and the practice is so common that game-laws had to be imposed stating a fixed period during which only the pasture could be burnt. As to the fire extending to the forests, Mr. Barlow shows that this can be prevented by regulating the burning by cutting fire traces and by notice to the authorities before the grass is burnt. Looked at from an agricultural point of view, burning improves hillpastures in many ways than one. It destroys the growth of rough grass which if unchecked

gradually over-runs the whole field at the expense of the better sorts. The ash of burnt grass also serves as a manure. Insects and grubs are also killed, thereby rendering the pastures wholesome to the cattle sheep etc. which graze on them.

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THE Royal Botanic Garden of Calcutta of which India may justly be proud is an institution the usefulness of which under its able superintendent Dr. George King has more than once been noticed in these columns. During the year ending 31st March 1885, the cultivation of several economic plants engaged the attention of the Superintendent. A fresh attempt was made to introduce the plantain (*Musa textilis*), from which Manilla hemp is derived; but, as on previous occasions, the cold weather proved fatal to every plant of this species. Of the Rhea plant, both stems and roots were distributed among persons interested in discovering a proper method of extracting the fibre. Another fibre, which has lately attracted considerable attention, is bow-string hemp, the product of the plant *Sanseviera Zeylanica.* Although not indigenous, the tree grows well in Bengal, and the fibre is said to be admirable, while it is easy of extraction from the plant. Dr. King reports as follows on the Japan paper mulberry:—

"In several of my recent reports I have referred to the Japan paper mulberry as a hopeful source of paper fibre for Bengal. I am happy to say that the trees of this species in the garden continue to grow well. Although now only three years old, they are twenty-five feet high, and have proportionately thick stems. The fibre contained in the bark is one of the best materials for paper known. It is easily separated, is strong, and requres little bleaching. As the tree grows thoroughly well and coppices freely, I think it quite possible that, in the course of time, natives may be induced to grow it on the odd corners of land which are so common near Bengali villages."

THE *sabai* grass, the suitability of which as a raw material for paper has been established beyond doubt, is now largely used in local manufacture. Attention has lately been given to an important alkaloid, called cocaine, which is extracted from the leaves of the cocoa plant; and this plant is now being propagated to a large extent for distribution. There have been considerable additions to the collection of dried plants, the contributors being Sir J. D. Hooker, Mr. Kuntler, Mr. Gamble, Mr. Duthie, Mr. Talbot, Dr. Cooke, and several others. The interchange of seeds and plants went on actively during the year, the issues amounting to 23,433 living plants, and 2,979 packets of seeds; and the receipts to 12 056 living plants, and 1,201 packets of seeds. The receipts from sale of surplus plants amounted to Rs 1,075-11-6.

WE learn from the Civil Military Gazette that a series of most interesting experiments in the cross-breeding of wheat has been brought to a successful conclusion this harvest, by Messrs. Carter and Co. of High Holborn. By crossing some of the finest kinds which have been hitherto produced by selection, entirely new sorts have developed. The experimental farm of the company is situated at Forest Hill, where one row of the hybrid is sown between a row of its parents on either side; the improvement and development of the new cross being visible to the eye. In one instance, a short strawed, velvet chaffed wheat was crossed with a large bearded American variety. The result was a medium sized plant, about a foot taller than the female plant; with minute awns on the apex of the chaff of each grain. This variety seems to have disgusted the sparrows, and it has accordingly been christened "bird proof." Red and white wheat have also been crossed, with a view to securing the advantages of both breeds; and it is expected that the offspring will be much appreciated by the importers. It ripens fourteen days before either of the parent plants. Among other peculiarities, the hybrids in many cases have firm-set grains which are not easily shaken out of the ear—an advantage to cultivators in "windy uplands golden with old corn." Every experiment has been marked by the vigour and productiveness of the crossed varieties, as compared with either of their parents. One plant bore sixty ears, averaging about fifty well-formed grains to the ear; or three thousand grains from a single seed.

MR. T. E. O'CONNOR has just published his review of the trade of 1884-85. The year was a bad one for Indian trade; the total value of which fell off by 1·66 per cent. This decline, as Mr. O'Connor points out, "interrupts a hitherto continuous record of expanding trade since the termination of the famine of 1877 and 1878." Since the end of the year reported on, there has been a further decline: the monthly returns show that the value of imports has fallen off by over 189 lakhs, and the value of exports by about 186 lakhs. But India was not the only country in the world which went through a period of depression. The

depression, indeed, was almost universal. If we look back, moreover, to a series of years, we find that the trade of India, during the past 12 years, has an average annual increase of 4·79 per cent.; against 1·78 per cent. for America, ·72 for Germany, and ·61 per cent. for France. In England, during the same period, there has been an average annual decrease. Compared, again, with China, this country can show an excellent record. In spite of her enormous population, the trade of China is very much smaller than that of India. Turning to the figures for the different provinces of India, we are told that Bombay and Scinde, during the the year, showed an increase both in imports and exports; Bengal and Burma a decrease under both heads; Madras, a large import and smaller export trade. The import trade of Bengal has shown no sign of increase for the last five years. In Bombay on the other hand, there has been a steady increase, both of exports and imports, for the last five years. Last year the imports into Bombay for the first time exceeded the imports into Bengal. The imports and exports of Scinde have increased considerably; though the totals are still small. Mr. O'Conor writes "Calcutta has decidedly lost her position as the chief centre of the foreign trade of India, in regard to merchandise as well as treasure; and Bombay now stands distinctly the first commercial port in India. The current of trade inwards as well as outwards has set in favour of Bombay, with the completion of the railway system connecting it with the north, centre and south of India; and it may be expected to set even more markedly in favour of that port in future."

It appears from the report of the Commissioner of Salt Revenue on the fish-curing operations of the presidency of Madras during the six months ending the 31st March last, that the new system is making its way, and that the fishing population is beginning to see the uselessness of the resistance, and is falling in with the arrangements made for it. This system, the intention of which is to substitute a supply of well-cured fish for the stinking stuff which has previously been sold as salt fish, consists in the establishment of curing yards, for the use of which licenses are issued to the fishermen, and in which salt is supplied free by Government, and it is practically rendered obligatory on the fishing class by the prohibition of the use of salt earth, which was formerly largely employed in curing. Although started in the year 1880-81, little progress was made till the end of 1883, by which time the Preventive force of the Department was sufficiently organized to make the prohibition of salt earth effectual, and so to force the curing trade into the Government yards. Since that time the advance has been rapid. The number of yards in which work was carried on increased from 109 in the half-year ending the 31st March 1884 to 123 in the half-year under review. The applications from fishermen desirous of using the yards have amounted to 83,838 in the latter period, against 51,888 in the former, and the quantity of salt consumed has increased from 42,246 maunds to 65,686. But of course the most important point is the supply of food rendered available, and here the advance has been equally deceive. The quantity of fish brought into the yards to be cured rose from 2,984 tons in 1882-83 to 11,789 tons in 1883-84, and to 20,108 tons in 1884-85. In the half-year under review 14,844 tons were brought in for curing against 9,141 tons in the corresponding half of the previous year, an increase of 62 per cent., from which, moreover, it is evident that the increase is still continuing. The result of this great development has been that the deficit, produced by the initial expenses of the undertaking, has been reduced in the half-year in question by Rs. 6,086, or by one-fifth, and the excess in the receipts over expenditure promises soon to remove the deficit altogether.

The Cotton Mills of the Tinnevelly Water Power Spinning Company have commenced work, and are worthy of notice, as one of the first, worked completely by water power. The water used is that which comes over the Tamerapurna falls in the Tinnevelly district, the capabilities of which some two or three years ago struck Mr. T. Harvey when travelling in the district, as capable of being converted to the purpose of working a mill. As some of the best cotton grown in India comes from the Tinnevelly district, it was considered advisable that a cotton mill should be selected; and after overcoming the usual difficulties in getting the concessions from the Government for making the channel and for the use of the water, the mill has now been completed. It is situated at a place where the stream falls almost perpendicularly for upwards of 800 feet, and then passes through a narrow gorge to the plains. The channel to the mill takes the water from the river, at a point some distance above the falls, to the crest of the hill overlooking the mills, from whence it runs in pipes down the hill to the turbines, after driving which the water goes back to the river about two miles below the spot from whence it came out. The turbines are two in-

number, and capable of working up to 250 horse power each. The power is conveyed from the turbine shafts by ropes, running in large grooved pulleys direct to the driving shafts of the mill, without any intermediate gearing. On the occasion of the opening of the mill, the whole machinery worked in a most smooth and efficient manner. The mills are likely to be of great benefit to the poorer classes in that neighbourhood, as already more than 300 persons are employed there daily.

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FROM the accounts of the trade and navigation of British India for the first five months of the current financial year, as compared with the corresponding period of last year, it appears that the total value of merchandise imported was Rs. 21,01,58,004 as against Rs. 22,49,60,117 and that of merchandise exported Rs. 33,46,09,379, as against Rs. 35,54,92,594. The value of treasure imported was Rs. 7,01,74,578, as against Rs. 6,64,15,244 and that of treasure exported Rs. 36,58,740 as against Rs. 86,31,851. The gross amount of import duty collected, including the salt duty, was Rs. 89,34 465, as against Rs. 96,81,227, and that of export duty collected Rs. 28,94,803, as against Rs. 21,45,735. With the exception of living animals, and railway plant and rolling stock, there was a decrease in the importation of all the principal articles in the list, the largest being under the head of yarns and textile fabrics, which amounted to Rs.1,07,16,449, the nett total amount of decrease being Rs. 1,83,15,283. In the articles of export there was an increase of Rs. 1,14,33,678 under the heading of articles of food and drink, and a smaller increase in metals, apparel and other manufactured articles, whilst all other items in the list show a decrease, that under the heading of raw materials and unmanufactured articles amounting to Rs. 3,19,24,721. The nett decrease was Rs. 2,14,66,948.

FROM the report of the Gondal State it appears that last year a quantity of fine wheat called "Bansi" was supplied to cultivators as seed, and the out-turn, which was pretty good, was received to be used as seed next year. The total value of cotton produced in the year 1884-85 was Rs. 361,090 against Rs. 244,158 in 1883-84. Irrigation continues to be encouraged by advances from the State Treasury to the cultivators for the purpose of digging wells and by the State contributing one-fourth of their cost. During the year of report 15 new wells were sunk, and there are now 2,810 wells in the State.

The value of imports and exports for the last three years is shown below :—

	1882-83	1883-84	1884-85
	Rs	Rs	Rs
Value of Import ...	25,85,167	23,48,195	23,73,679
Do. Export ...	13,28,213	18,04,245	18,04,425

The total value of the trade this year is almost the same as last year. The figures given above cannot be relied upon as quite correct, but they give an approximate idea of the trade. The chief manufactures of this State are cotton and woollen cloth, gold embroidery work, wooden toys, and wood-work turned on lathe, and brass and copper utensils. The cotton chofals, dhotars, towels, etc., the woollen dhablas, the cotton and silk turbans and the wooden toys of Dhraji, the wood-work turned on lathe of Dhoraji and Sarsai, and the metal pots of Gondal are well-known. The demand for these is said to have been fair. There were 685 cotton and 70 wool-weaving hand-loom establishments in the State during the year ending 31st March, 1885, against 630 cotton and 25 wool-weaving establishments during the previous year. It will thus be observed that this industry has prospered during the year of report. The local trade consists chiefly of cotton, yarn, oils, molasses, wool, cereals, hides and skins, as articles of export; and timber, cotton, woollen and silken cloth, gold, silver, and other metals, sugar and ghee as articles of import.

WE learn from a local contemporary that the weather in Assam and Darjilling still continues to be unfavourable, and that the blight is so bad in the Terai that the out-turn will be seriously affected.

THE indigo brokers estimate the total outturn for the season at 110,000 maunds, a large falling off from the 165,507 maunds of last season, which falls considerably below the original estimates. The falling off is chiefly due to Behar and the North-West Provinces. In the former the outturn is expected to amount to only 52,650 maunds, as against 62,038 maunds last year, whilst in the North-West Provinces this year's crop is estimated at under 40,000 maunds as against .84,8000 maunds last last year. The heavy rain that fell late in the season largely reduced the produce from the Khoonties in Behar, whilst the unfavourable season generally is said to have been the cause of the falling off in the North-West Provinces.

A USEFUL feature has been introduced into the report on the external trade of the Punjab for the year 1884-85 in the shape of a map illustrating the various principal trade routes from the Province. The most interesting fact in the report is that the foreign trade of the Province has been steadily decreasing since 1880-81. In that year the total value of the import and export trades was Rs. 2,46,20,718, whilst in the year 1884-85 it was Rs. 1,88,75,840. Nearly one-half of the foreign trade takes place with Jammu and Kashmir, which countries also furnish the most valuable imports, and it is satisfactory to see that both import and export trades with these countries show a steady and healthy increase. The principal trade route is through the Dankok line in the Gurdaspur district, but it is thought that the opening of the Amritsar-Pathankot Railway will divert a considerable quantity of traffic to the Bassauli route. On the other hand the trade with Kabul has shown a considerable falling off during the last three years. In 1882-83 the value of imports was Rs. 31,01,627, whilst last year it was only Rs. 23,86,660, whilst in the same time the value of exports has fallen from Rs.57,33,272 to Rs.46,48,630. The only satisfactory feature in connexion with the Kabul trade is the increased export of Indian tea. The quantity taken in 1882-83 being 5,933 maunds, valued at Rs. 2,99,241, whilst last year this had increased to Rs. 8,826 maunds valued at Rs. 3,93,198. There also appears to have an increase in the export of tea to Ladakh, where the people are beginning to appreciate its superior quality over that they previously purchased. The Lieutenant-Governor comes to the conclusion that the trade with the frontier cannot be considered in a satisfactory condition.

IT is very satisfactory to learn that the system of practical teaching in the principles of agriculture, which the Director of Public Instruction (Mr. H.W. Green) set himself so earnestly to develop, is really taking effect throughout the island of Ceylon. We learn that in every Government Vernacular or Anglo-Vernacular school in the higher standards, theoretical agriculture has been taught since last January in the same way as in England, the text-book used being a translation of the Director's 'Primer of Agriculture." Then again all teachers are now compelled to pass in theoretical agriculture before they can get a certificate - a very important stimulus. As regards practical lessons, the "Colombo School of Agriculture" has this year commenced actual work. The students have been trained in school compound in the use of the new ploughs, and they are going to plough five acres of paddy land belonging to a private owner, for which the records of resulting crop are to be carefully kept. The owner of the land will cultivate in the ordinary way alongside of this piece of land which the school cultivates. The comparison can not fail to be instructive, and the crop returns altogether if carefully entered should be interesting in connection with the subject of paddy cultivation. Several of the more intelligent Government school-masters are, we are glad to learn, also cultivating after this fashion. As soon as the Director can provide teachers, it is we understand his intention to seek leave from Government to start practical agriculture at several country schools, a piece of land being allotted to each school and the teacher being partly paid in produce, so as to give him a pecuniary interest in the proper working of the land. This ought to prove a most interesting and beneficial experiment; but manifestly Mr. Green will require a little time to make the necessary arrangements.

ALTOGETHER, we are agreeably surprised by the progress made by the Director. And it shows that it is not simply through the medium of the Government Department alone, the work is being done, when we learn that several dozen of the ploughs recommended for paddy field have been sold privately, apart altogether from the Government and without any inducement from the Director, although the latter has officially and very properly sent some ploughs to each Kachcheri. But, after all, we may expect more to be done through the gradual influence of the schools than in any other way. No doubt the Government Agents, or at least some of them, will help very cordially; but still a Government Agent, even with the best intentions, can only work on adult men with grown-up conservative prejudices against new fangled ideas; while the Director of Public Instruction may well hope to be able to train up a certain percentage at least of the school-boys who can eventually put in practice on their own lands what they learn during their agricultural training. For the prize-takers in this Department who may carry out in after life the lessons they have learnt, the Governor of the day will, we have no doubt, be ready to provide encouragement and reward in the shape of the honour so dear to the native mind and heart. By and bye we may find a regular system established for drawing the native assistants to the revenue officers, in all the grades of headmen, from the passed pupils of our Agricultural Schools.—*Ceylon Observer*.

FROM a mass of correspondence relating to white silk-cotton-tree (Eriodendron anfractuosum) commonly known as *Bitiburgadamara* in Canarese, we learn that the tree is most abundant in certain Taluks of the Tumkur, Mysore, Shimoja, and Hassan districts, and in the forests of Shimoja and Hassan. The reports of Messrs. Lovery and Graham Anderson are of special interest. In cultivation, the tree is extensively used as a support to the betel-vine, a purpose for which its rapid growth and naked understems render it well suited. Mr. Dickinson, the conservator of forests in Coorg, is of opinion that the moister climate of south Canara is better adapted to its requirements than any part of Mysore. The tree can be readily propagated from pods or stake-cuttings, which is an important matter in facilitating the quicker development of fruit-bearing plants. *Kapok* is ready for harvesting in the beginning of summer or in the months of February and March. After separating and well clearing, 22 lbs of *kapok* were divided for despatch to the valuators at London and Rotterdam. The reports submitted from the latter are favorable as regards quality and condition of the samples submitted for valuation but the prices offered are so low that the expediency of taking any further steps to advance this industry is extremely doubtful. Where *kapok* is plentiful in the forests, it might pay to collect and export it, but certainly not in any limited area of cultivation. The London market does not require *kapok*, but they are anxious to obtain a few similar materials at low prices.

AT the ordinary monthly meeting of the Agri-Horticultural Society of India, held on the 26th August, communications from various sources were read, among which were two from Mr. Finucane, Director of Agriculture, Bengal, applying for a supply of Sorghum-seed and for an enquiry regarding imported tobacco-seeds. He wishes to make some experiments as to the cultivation of Sorghum for fodder, for which he was supplied with three pounds of seed. Mr. Thorp, of the *Sugarcane*, Manchester, remarks on the falling off of exports of sugar from the port of Calcutta and considers the change which has taken place in the value of sugar since the beginning of the year very cheering, and is confident that prices will rule higher still up to the close of the year. According to his request, Mr. Slack of Giridi was supplied with a packet of the seed of *Reana luxurians*, an excellent fodder-grass, with instruction as to its culture. An exceptionally large specimen of jack fruit, 3 feet in length, 3 feet 5 inches in girth and weighing over 60 lbs as sent by Mr. A.C. Blechynden, of Doomra Factory, Sitamarhi. Dr. Bonavia of Etwah communicated with the society wanting to have all available information about the different kinds of Oranges and Lemons grown in India, their cultivation and trade. There were also communications, requiring information about the cultivation of Patna Onion, and Ceará Rubber. Messrs. Lloyd and Co. exhibited some fine samples of Maize grown in the Terai. The cobs were grown from the seeds of last year's crop, which again was the product of Australian seed. The above Company's experiments prove that a very superior class of seed maize can be grown in the Terai the distribution of which in various parts of India would have a marked effect on the quality of this stapple. Mr. Wood Mason's report on the insect pest *Paraponyx oryzalis* affecting the rice plant in Burma has been presented and will be published in the Journal of the Agri-Horticultural Society.

OUR readers may remember that a few months ago we published an analysis of Mr. Hallen's report on M. Pasteur's system of inoculation for the prevention in cattle of anthrax which is better known in this country as Ludhiana fever. During the last two years, experiments have been carried on by veterinary surgeons in both Madras and Burma for the purpose of testing the efficacy of M. Pasteur's system. Mr. Batchelor, who was specially sent from Madras to Singapur to investigate an outbreak of the disease in that colony, records a case in which a fly from the carcase of an animal which had died of anthrax settled upon a sore on a man's face, and that shortly afterwards the man was attacked with anthrax and died. Other well authenticated cases are also recorded. That the disease is communicable to man is not unknown. In man it is known as *malignant postule* and in Manchester as *wool stirrer's disease*, because men in the woollen factories catch the infection from the wool of sheep which had died of anthrax. Mr. Batchelor subjected the vaccine matter supplied to Government by Pasteur to microscopical examination and discovered the existence in it of several *Anthracis bacili*. He also ascertained that the germs are developed from the vaccine by age and changes of temperature and that the average temperature is favourable for their development. Hence it was apparent that the success and safety of a system of cattle-anthrax-inoculation in India, depended upon the production of anthrax vaccine in this country. The Madras Mail understands that Mr. Batchelor has established a laboratory in Octamund and he has recently forwarded

a first consignment of his vaccine to the Director of Agriculture. Extensive experiments are to be tried by the Government Cattle Inspector, Mr. Mills, and if it is proved that this vaccine is equal to that supplied by Pasteur, and free from the disadvantages attributed to vaccine that has been kept for some weeks in a hot climate and subjected to changes of temperature, an enormous gain will accrue to the Presidency. This vaccine has been microscopically examined under a lens of 1,000 power and found to be free from the slightest trace of spore-rod, or *bacillus.* Every credit is due to Mr. Batchelor for his enterprise in undertaking at his own cost, the journey to Europe and the purchase of the expensive apparatus necessary for the successful cultivation of vaccine; and as it is the intention of the Governmnet Inspector to inoculate millions of cattle in this and succeeding years, the saving by using anthrax-vaccine of Indian manufacture (which can be sold at half the price of Pasteur's) will be very large. In the event of Mr. Mills' experiments proving as successful as anticipated, it would seem expedient for the Government of Madras to follow the example of the Straits Government, and pass an Act making the inoculation of cattle compulsory, and to enable the ryots to have their cattle protected by inoculation at a nominal cost.

The cultivation of tea in the Punjab or rather in the Kangara Valley is making considerable progress. During last year there were 1,925 plantations of which 34 were new. As many as 1,880 gardens are owned and worked by natives of India. The total area under tea during the year was 8,172 acres, of which 6,430 acres were under mature planting. Other 1,756 acres have been taken up for planting. The out-turn for the year reached 1,334,002 lbs. Showing an increase of 34,000 lbs.

In recording a minute on the abolition of the Government Farm at Saidapet, Mr. Wilson, the Director of Revenue Settlement and Agriculture, says that an agricultural reporter could not travel about and make himself acquainted with the agricultural conditions of the presidency, so long as his connection with the school of agriculture remained unsevered. He showed also that the school had been a failure chiefly because it was impossible to give the students that careful and individual training in practical farming which was an indispensable preliminary of the scientific course, and which in other countries is given beforehand by independent farmers farming their own properties. His proposed remedy involves the separation of the school from the Agricultural Department, and the bringing of the latter into more practical and intimate relations with the agriculture of the country, precisely as contemplated by the Government of India. Under his scheme the school of agriculture would be purely scientific, and the Agricultural Department nothing if not practical. After a while, it would be made a condition precedent of admission to the school that the candidate should have studied practical farming for two years. For the purpose of affording this practical training, Mr. Wilson at that time contemplated the establishment of Government example farms. But this idea he seems since to have abandoned. His Excellency the Governor in Council concurs entirely with the latest expression of the views of the Director of Settlement and Agriculture.

With regard to the future agricultural policy of the Government, His Excellency the Governor in Council proposes in the first place to abandon the Saidapet Farm on its present scale as a practical failure. The work, there, has excited some general interest among the agricultural population in improved agricultural machinery, but little more than this has been accomplished. The farm is too small for stock breeding, its soil is unsuitable and our knowledge of Indian crops too limited as yet for useful experiments. No new farms will be instituted, but experiments will, where necessary, be carried out, with the assistance of private agency under the general supervision of the Agricultural Department. Meanwhile, native agriculture and the analysis of districts will be carefully studied by the Agricultural Reporter with a view to introduce better methods where they are wanted, but there only. Further than this, the Government are not at present disposed to go. To assist the Agricultural Reporter in investigation, the Government propose eventually to entertain a small body of District Agricultural Inspectors whose salaries will be met from the savings which will accrue from the abolition of the farm. These men will, previous to their entertainment, have undergone a course of training at the Government agricultural school. The further proposal of the Director of Public Instruction to attach some 30 or 40 acres of land to the college as a farm *annexe* as a field for practical demonstration and training for the students of the college is approved; the management of this land will be under the control of the Educational Department. The necessary details of administration of the agricultural school, and the course of instruction to be followed therein, will receive consideration in the Educational

Department, to which department these papers will be now communicated.

THE abolition of the farm is one of those retrograde steps and examples of short-sighted policy of the Government, the effects of which can not be too strongly condemned. If the farm did not work well, at least not to the satisfaction of the Agricultural Department, it might have been remodelled and put on a sounder basis. But to have kept it on for years, at an immense cost to the State and then to abolish it, is utterly suicidal. This result seems to us to have been due to a misunderstanding of the manner in which the farm was worked. From the method of working the farm, it was evident that it was more of an experimental than model nature and the main object of experimental farms should not be so much to earn profit as to elucidate principles of scientific and hence most paying system of agriculture.

* * *

THE system of sugar-cane cultivation as pursued in British Burma is much superior to that of Bengal or India generally. A short outline, therefore, of the former, will not fail to be interesting to many of our readers. The cane-producing lands of British Burma may be roughly divided into two tracts, (*a*) the tract of shifting cane-cultivation in which the cane is consumed in raw state and (*b*) the tract of permanent cane-cultivation in which the cane is pressed and the juice manufactured into *gur* locally called *kyantaga*. The first tract consists of patches of land cleared in the evergreen jungle which fringes the tidal creeks; the land is as a rule poor and will not yield a cane crop two years in succession. The area under shifting cane cultivation is no more than 280 acres, each holding scarcely exceeding one acre and the cultivators being principally Burmans. The kind of cane grown in this tract is called *kyauktwin* or *kyaukchaung*, a large cane of light color with short thick joints and so brittle that it breaks off easily at the joints. It is very juicy and usually eaten in the raw state, the cultivator never attempting to make *gur* of it. The juice contains but little saccharine matter. No amount of boiling causes crystallization of sugar.

THE sites selected for cane-cultivaton are the muddy clay alluvium on the banks of tidal creeks overgrown with jungle. The timber on the plot of land selected is cut down at the beginning of the dry weather and burnt in March. Vegetables, such as roselle and Indian corn, are planted amongst the ashes and afterwards sold at a small profit. In September, after the land has been cleared of weeds, cane-pieces are planted in holes at a distance of two or three feet. These holes are in rows three or four feet apart; the cane-pieces are fastened down by a piece of bamboo lashing to prevent them being washed away. In January and February loose soil is thrown up round the young plants, and in May and June supports are placed near each cane stool and canes tied to them with fastenings made of creepers. About August and September the canes are cut and sold in pieces. In some parts trenches are made to admit water during the dry season and drain the land during the rains. In other parts the plants are watered at spring-tides by bamboo water-lifts; but, as a rule, the water from the creek overflows the banks at high tides and no irrigation is necessary. The cost of cultivation per acre is on an average Rs. 60 and the yield about 17,000 canes. The canes sell at Rs. 20 per 1000, so that an acre would give a return of Rs. 340. Deducting Rs. 60 as the cost of cultivation, Rs. 130 the cost of living of the family, and Rs. 50 for other small items as attacks of rats and squirrels and inroads of cattle etc., the net profit may be estimated at Rs 100 per acre.

THE tract of permanent cane-cultivation is situated mainly in the valleys of rivers, the area being 6,980 acres. The canes are of various kinds, but the *Madras* or *white cane* is almost exclusively grown in Burma for the manufacture of *gur*. It grows to a height of 10 to 12 feet and is so flexible that it requires no supports. The soil on which cane is grown for manufacturing purposes is in river-valleys or in other districts of the province which are generally deep rich loam. The mode of cultivation may be compared to planting in contradistinction to broad-casting. Where new land is cleared, or land already cultivated has been left fallow, the cultivator turns up the soil with a hoe at the beginning of the rains (May or June); he then leaves the soil to rest until September, when he digs holes about 10 inches deep and 1 foot wide at intervals of 1½ foot from each other. Three pieces of cane (agyaung), about five inches long, are then placed in a standing position in each of these holes, so that one end of each plant touches the ground and the other protrudes about an inch over the top of the hole. The cane-pieces are then

partly covered up with loosened earth. There are generally three joints to each of the cane-pieces, and each joint has one eye. Many of the young shoots being, however, destroyed by the he at or other accidental causes, it is seldom that more than five or six canes are found to one stool. Some cultivators plough their land three times at the beginning of the rains instead of turning it up with the hoe; but the more general practice is simply to run deep furrows through the land in September and then place the cane-pieces longitudinally at the bottom of the breach, which is about 10 inches deep and 1½ foot wide. The space left between the furrows varies from two to three feet, according to the nature of the soil. Before the cane is planted, the land is cleared of grass and weeds. About 10 days after the cane-pieces have been planted, the earth is loosened in the intervals between the holes and the cane-pieces further covered up with mould. In the month of January the earth is again loosened and the plants further covered up. About the month of May, the land is again cleared of weeds and grass, and the plants are then left until the month of August and September, when they are stripped of the leaves that have become old and withered.

The cane generally cultivated for manufacturing purposes is so flexible that it does not require any support; the canes are not therefore tied in clusters in these plantations in the manner described for plantations on the tidal creeks. The area of each holding is seldom over an acre. Irrigation is hardly resorted to excepting in exceptionally dry season. The canes bloom about the month of November, they are then severed with an iron hook (dá) from the stool close to the ground. The branches at the top are given to the cattle as food and the top, which is cut off where the hard cane ends, preserved for planting. The canes are then divided with the hook into two pieces of about 4 feet each, tied up in bundles and carried by the cane-cutter to the mill, where they are bruised and juice extracted. From the stools left on the ground after harvesting the first year's crop, three or four young shoots or ratoons spring up. When these ratoons are sufficiently thick, no new cane-tops are planted after the cane has been cut, but as a rule cane-tops are planted in the intervals till November when further planting becomes impossible for increasing heat. In some places even three cuttings are obtained but the juice of the last one contains but little saccharine matter. As a rule after the second year's crop, the land is either left fallow for a year or again planted with cane-tops and then left fallow the following year.

In the memorandum under notice, there is a very interesting report on the analyses of soils on which canes were grown and on the testings of juice and *gur* made therefrom. The analyses of the soils show that some of these lands are very rich in potash and phosphoric acid and these are the very lands which the cultivators from their practical experience declare to be very fertile and produce the best juice. It is worthy of notice that the sugar obtained is very nearly proportional to the percentage of phosphoric acid. In the table of analyses which is otherwise very valuable, we miss three very important items, namely, the percentage of soluble matter, that is, matter soluble in distilled water, the percentage of organic matter and that of soil-nitrogen. Neither the percentage of soils soluble in distilled water nor in acids, shows the exact amount of soil-matter available to plants, but the two together give an approximate idea of the amount of soil-matter available to plants. The significance of the percentage of organic matter and of soil-nitrogen is too well known to need any explanation from us. The omission of these three items from the table of analyses is therefore to be regretted.

* * *

The cost of cultivation in a plantation worked entirely with hand labor would amount to about Rs. 90 per acre. The greater number of cultivators, however, hire little or no labor and work the land with their families. The average cost may be estimated at Rs. 15 to Rs. 20 per acre. The system of *gur* and sugar manufacture, crude as it is in whole British India, is cruder still in British Burma, and as the Indian cultivators have nothing to learn from the system of manufacture of their Burman brothers, it is useless to give its details here. It need only be mentioned that Mr. Mylne of Messrs. Thompson and Mylne of Beheea, visited British Burma at the beginning of the year and, considering that the Burman method of preparing and boiling the juice was defective, showed them the improved methods of boiling in a shallow pan after clarifying the juice with a decoction of the rind of the root of *Abemeloschous esculentis* and of the crushed seeds of *Ricinus communis* (Castor oil plant). By the new method there was a considerable increase in the percentage of crystallizable sugar. In holdings worked entirely with hired labour the cost of

cultivation amounts to Rs 90, and the cost of manufacture to Rs 60 per acre. The average outturn per acre (3,500lbs. at Rs 25 per 878 lbs.) is worth Rs250; the net profit per acre, not including cost of living, would therefore be Rs. 100. In small holdings the cost of cultivation has been estimated at Rs. 20 per acre, and the cost of manufacture being Rs. 60, the net profit would amount to Rs. 170 per acre. In small holdings which do not measure more than one acre, the cultivators spend all the profit in supporting themselves and their family, and in the larger holdings the profits of cultivation often go to pay the interest on money borrowed. Taking the total area under sugarcane in the permanent tract to be 7,000 acres, and the average outturn at 2,800lb. of *gur* per acre, the amount of sugar produced in one year would be 8,750 tons; the whole of this is consumed in British Burma excepting small quantities exported from the Akyab district into Chittagong. Refined sugar is consumed only by Europeans and Burman traders in the large towns, and the imports of this latter kind amounted last year to 78,869 cwts.

AT a meeting of mine managers held at Raniganj on July 26th 1884, a paper was read by Mr. Chater, in reply to the question, Is legislation necessary to regulate the working of coal mines? It was resolved that "considering "the present harmonious relations between the "employer and employed; the perfect freedom of "action the latter enjoy under the former; the high "rate of wages now paid for mining-labour; the "almost total absence of accidents and accidental "deaths from roof-falls, inundations, and other causes; "the perfect immunity of the Indian mines from "dangerous and explosive gases, rendering artificial "ventilation unnecessary; the insignificance of the "present Indian coal-out-put, and the comparative "nascent condition of the mining industry in the "country,—this Meeting is of opinion that the time "has not yet arrived for legislation in the manner "proposed by the Executive." If the state of affairs is what the experienced managers represent them to be, there seems to be no necessity for legislative interference in the matter.

MR. BYOMKES CHAKRAVARTI, one of the Bengal Agricultural Scholars, has passed out of the Royal Agricultural College at Cirencester with great credit.

AGRICULTURAL IMPROVEMENT.

III.

To meet the requirements numbered above as I, II, and III, we propose that a model farm, an experimental plot, and a well-furnished analytical laboratory be established side by side. For reasons which will presently be explained, the model farm, though worked in connection with the experimental plot and the laboratory, should be kept strictly a separate establishment. About 200 acres of land we consider as quite sufficient for the farm, only half of which is to be worked for the first two or three years. This will require a working capital of about Rs. 12,000 to begin with. The farm we propose should be worked for the present in the most approved method of agriculture known to the Bengal ryot. As the farm is not to set an example of the most profitable way of cultivating the land, nothing of a doubtful nature is to be introduced in its management. Any variation in the cultivation of crops; any crop not already cultivated by the ryot; application of any new manure, in fact anything not recognised in the system of agriculture hitherto followed by the ryot should be severely tested in the experimental plot, and then introduced with the caution of one farming for profit.

For managing a farm, Government agency is considered defective in one great respect. "There is not the same incentive to gain which a private farmer has, the same anxiety to buy cheap and sell dear, to get workmen at the lowest wages and exact the utmost work from them, to make petty savings in every direction." To avoid this defect which might prove fatal to the success of the farm, we should propose that half of the profit that may be realized on the farm, after paying an interest of six per cent on the capital, be divided among the labourers, the bailiff, and the superintendent of the farm.

If it be worked in the way we suggest, and if every precaution be taken to prevent it from being reduced to a so-called experimental farm, we have no doubt that the farm will prove a profitable institution. The farm therefore is likely to meet the first and the third requirements mentioned above, *viz.*:—

1*st.*—It will be a place where, in the beginning, we shall learn the present system of agriculture in Bengal, not by putting questions to the ryot and then trying to decipher his almost unintelligible answers but in the only way in which an art can be learned, *viz.* by observing it successfully worked.

2nd.—It will be the place where we shall be able afterwards to show the application of the results of experiments, made with all necessary care in the experimental field and in the laboratory. It will thus, in time, become a really model farm where the ryot will see an actual example of the most scientific and profitable mode of cultivating the land.

To meet the requirement numbered II, we propose that, close to the model farm, and as far as possible on the same sort of land, there be an experimental plot covering about 50 acres of land. Only a small portion of this land will be required in the beginning, but as some of the experiments must be carried on the same land continuously for a number of years in order to avoid the disturbing influence of season, and as in succeeding experiments more and more of fresh land will be in demand, it will be an advantage to set aside in the beginning rather a large piece of land for experimental purposes. A fixed annual grant should be made to pay the expenses of the experiments. This grant may be about Rs. 1,000 in the beginning, with the condition that any money received from the sale of the produce of the experimental plot may be added to this sum. It should be carefully borne in mind that this plot is not intended to bring in any profit, and its value is to be estimated solely by the nature of the experiments and the accuracy with which they have been made.

The experiments, as stated before, will be made partly in the field and partly in the laboratory. It will therefore be necessary to have close to the experimental plot a well-furnished analytical laboratory. This, no doubt, will prove rather an expensive establishment, but those who have paid any attention to the history of modern European agriculture, from the time when Baron Liebig presented his valuable book on agricultural chemistry to the British Association for the advancement of science, and suggested the conversion of insoluble tricalcic phosphate into soluble superphosphate by treatment with acids, to our present time, will admit that chemistry has been the right hand of scientific agriculture and it is impossible to dispense with its services.

To meet the requirement mentioned under the fourth head, we should suggest, that in the first place, a college be established to teach the scientific principles of agriculture as well as its practical operations. The college must be well equipped with competent professors, laboratory, botanic gardens, etc., to teach important sciences connected with it. It will be too early to draw a detailed plan for an agricultural college in ... content ourselves by naming the subjects that ought to form parts of a comprehensive course in the scientific principles of agriculture and then point out the advantages of having such an institution somewhere close to the technical college at Sibpore. It will take a student three years to go over the whole course, two thirds of this time being spent in the laboratory, fields, and gardens

(1) *Agriculture.*—Theoretical and practical, including tillage operations, manuring, implements, crops and livestock.

(2) *Chemistry.*—Inorganic and organic with chemical manipulation, qualitative and quantitative analysis in the laboratory.

(3) *Agricultural Chemistry.*—Including quantitative analysis in the laboratory.

(4) *Botany and Geology.*—As much as is necessary for the proper understanding of the main subject.

(5) *Veterinary Science.*—Including diseases of horses, cattle etc. and their treatment, with as much of physiology and osteology as will be necessary for the proper understanding of the main subject.

(6) *Surveying.*—Including Drawing and Mensuration.

(7) *Physics.*—General principles of.

(*a*) It will be seen that, of the subjects mentioned above, provision already exists in the technical college at Sibpore to teach the elements of physics and chemistry. (*b*) No better place to teach botany exists in the country than the one close to the Royal Botanic Gardens. (*c*) Thirdly, in connection with agricultural implements, the services of the able Superintendent of the Government Workshop at Shibpur will be of immense value. (*d*) Again, an agricultural college being altogether a new thing in the country, it is likely to be better appreciated and more numerously attended if placed close to the metropolis than in a remote corner of the province. (*e*) Lastly, one of the indispensable requisites of an agricultural college in any degree deserving of the name, is a good chemical laboratory where analysis of soils, manures, ashes of plants, and articles of food may be done with the aid of all improved appliances that the progress of the different industrial arts has placed in the hands of the chemist to ensure all possible accuracy in his undertakings. Such a laboratory, it is superfluous to say, is almost an impossiblity in a place where coal gas is not available. This wil

necessitate the college being placed in Calcutta or somewhere close to it.

In the second place, we propose that the elements of agriculture be taught to all students attending the first class of the primary schools in Bengal. The subject, if only little care be taken, may be made extremely interesting and useful. One of the first requisites in teaching any branch of physical science is that the objects treated in the text-books be placed before the students and the instruction be not simply verbal. For this reason the attempt that was lately made to include chemistry among the text-books used in the vernacular schools, and to teach such an extremely experimental subject to students who have not seen even a single test-tube, was anything but a success. This difficulty need not arise in connection with the teaching of agriculture, as the students will see the subject illustrated every day close to the school-house or at home, most of them being children of peasants. It will also not be at all expensive to have a small garden attached to the school-house which can be kept well by the teacher and students as much for amusement as for instruction, with only occasional help of hired labour.

It will be necessary to have a small text-book on the elements of agriculture for the use of these schools. The book should be written in simple and clear language, and only well-ascertained facts and nothing of a doubtful nature should have a place in it. The book may be divided into two parts, the first part treating of the general principles on which agricultural operations depend, and the second part containing simple and clear directions for the cultivation of ordinary crops.

In connection with the teaching of agriculture in elementary schools, we should suggest that it would be a great gain if the Sub-Inspectors and Deputy-Inspectors of schools could be taught a little of agriculture and the sciences on which it is based. These gentlemen need not be learned scientific scholars, but with only an elementary knowledge of the most important branches of physical science, they can do an amount of good which one not knowing the opportunities these men have, will find it very hard to believe.

To diffuse a better knowledge of agricultural operations among the really agricultural population of the country, agricultural shows may be of great help. These shows must not be on a large scale and held in large cities, which are seldom visited by men for whom they are especially intended, but what we want are small shows held in sub-divisional and other large market-places regularly once a year.

A cheap paper, written in simple language, and containing matters relating to agriculture and other important arts, may be of some service in this direction, but at the present moment we can expect to reach this way only people in and near about large towns.

In conclusion, we should make a suggestion regarding the irrigation of cultivated fields in Bengal. In Bengal, irrigation not being so absolutely needed as in the United Provinces and some other parts of India, and the engineering difficulty being very great in most parts of Bengal, canal irrigation, we believe, will never be adopted. Irrigation by wells again, will not prove easy, as the country is submerged under water during the rains. A third method however, of irrigating the lands, might be adopted, that is, by means of ponds. Several advantages may be expected from the introduction of this system of irrigation in many districts of Bengal.

1st.—A good portion of the crop could be saved this way during the time of drought.

2nd.—Water being available, potatoes, sugarcane, and other valuable crops could be grown in places where the peasant must now be contented with much less valuable crops.

3rd.—These ponds will supply good water to many villages where, for a considerable time of the year, the want of drinkable water is badly felt.

4th.—If fish be cultivated in these ponds, the sale of these fish will more than pay the interest on the capital sunk in digging these ponds.

These irrigation and fish-ponds may, with advantage, be placed under the management of local boards.

A NOTE ON RICE CULTIVATION

IN KASHMIR.

As one of the aims of the Agricultural Gazette is to promulgate agricultural practices of different provinces of India by which one can improve its own and instruct the other, I fancy, it would not be out of place, if I make a few remarks here on the subject of paddy cultivation in Kashmir. The paddy as the rice in husk is called, is the principal food of the inhabitants of the "Happy Valley." It can be found in its wild state in some of the Himalaya-mountains. It is not intended in this

paper to write out its history but simply to describe the existing mode of its husbandry in the territory. I would not therefore tax your readers with any further technology respecting it.

The varieties of this plant which have originated from difference of climate and modes of cultivation, are more numerous than those of any other grain crop. In the territory of Kashmir there are three large divisions of this plant, *Basmati*, *Souga*, and *Shathi*. Basmati has two varieties, the common and *Sian* or superior kind which is chiefly grown in the vicinity of Jammoo and is used generally in the kitchens of Their Highnesses the Maharajah and Princes, Dewans and Visirs and is not commonly sold in bazar. The grain of this variety is large, clean and snow white and it emits a sweet smell when boiled and possesses the butter absorbing power more than its other varieties. Its flavor and nutritious quality are superior to the ordinary kind. The percentage of gluten present in it is great. Various attempts have been made by the Kashmir Agricultural Department to introduce this variety into Kashmir proper (Srinagar), but the results were not encouraging, but I am afraid, the non-success was due more to the carelessness and indifference of the under officials, than any climatic influence. *Souga*, which has fifty-six varieties with two classifications of Red and White, grows throughout the territory. The latter is generally consumed by the middle class, and the former by the common mechanics and cultivating classes of the country. Shathi or Satwa, which grows on dry land, is an early kind of rice. Its name, I believe, is derived from its ripening in sixty days. It has some affinity to the *toara* of Bengal. In Kashmir proper it has been lately introduced by its present ruler.

All varieties of paddy except shathi flourish best in low marshes or on lands flooded during the greater part of the season with water from the inundation of rivers or overflow of the chashmas (natural springs). Any one visiting Kashmir during June and July, can see from the top of the Pir Panjal, the highest range of mountains that divides Jummo and Kashmir, a vast sheet of water overgrown by the luxuriant saplings of green rice plants.

The general mode of rice cultivation in Kashmir is as follows:—As soon as the snow begins to thaw, the ploughing of land for paddy is taken in hand. After the land has been ploughed and harrowed, manures which consist of chimney and house-sweepings, nightsoil and farm-yard-manure are applied to the land. Cowdungs and droppings of horse, goats and sheep, are commonly made into *chipti* or dung-cakes for the use in chimney and *kangry* (an earthen pot bound neatly with willow twigs in artistic basket-work to hold fire and hung by the Kashmirese under their loose garment to keep themselves warm during freezing winter) during winter, but those that are gathered during winter are allotted for manure. When a field is ploughed and harrowed thrice, it is ready for seeds. Meanwhile *nurseries* or seed-beds are thickly sown for transplanting in low-lying lands. Highlands are generally sown broadcast. Kashmir husbandman shows great prudence in the choice of his seed-paddy. Seeds are kept in straw-sacks with great care in some warm place of the dwelling during the year. When time for sowing approaches, the sack is opened and seeds are dried in the sun for three days and steeped in water for 24 hours. Next morning, seeds being taken out of water are spread on the floor to dry. This operation is continued three times and when the grains are found to have been duly bleached they are filled in a woollen sack and kept in this state for 4 days in some warm place and now and then sprinkled with water to keep the seeds moist. In seven days' time, sprouts become ¼ of an inch long, they are then ready for sowing broad cast, but if they are larger than that, they are sown in nursery-beds. By the above treatment, the red variety turns to white, one which is greatly esteemed in Srinagar market. The sprouted seeds being sown broad-cast, the land is once more ploughed with a view to give cover to the sown seeds and it is flooded with water 4 inches deep. In a week the plants come above the surface of the water, when a dozen of cattle are made to walk over the field to turn the soil into mire. Sixty-four pounds of seeds are required for sowing an acre of land broad-cast, but less if transplanted from nursery. Between the 15th and 30th of May, the operation of sowing is finished. From the 10th to the 20th June, the operation of transplanting is commenced, when plants in nurseries grow to the height of 648 inches and finished by 20th July. Before transplantation is commenced, the land is irrigated and inundated by river and spring water and an overflowing from field to field is continued throughout the whole growth of the rice plants. In October when the plants are about to ripen, the water is gradually taken out of the field. The paddy field is hoed thrice during its growth but the operation is not executed by any sort of tool but half a dozen of men stand hand in hand and press the soil with their feet. Before doing this, they rub their feet with pine-tar to obviate water soaking into their naked limbs. One man and a woman with a pair of bullocks and a plough can cultivate 4 acres of rice field unaided.

When the crop is ripe and the water from the field is drawn out, a long pole of Babubu or pine, having strings tied to its two extremities, is drawn by two men from one end to the other, inorder to give the standing crop a lying position which facilitates the reaping operation. No sooner the above operation is over, than men, women and children from 12 years and above flock to the field with scythe in their hands. Hired labor is little availed of by the Kashmir rural community. They help each other in their farm work. As much as one can grasp in his left hand is called *mooth* and 6 (six) *mooths* are tied into a bundle, about 1900 bundles are the out-turn of an acre of average kind of field. Each bundle produces 2 to 3 lbs. of grains. The present out-turn of a field is estimated at 40 to 80 times the seed sown. The annual out-turn of paddy in Kashmir is about 548,150 tons.

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RICE AS GROWN

IN BHAGALPORE AND MONGHYR.

PERHAPS an account of rice cultivation in these districts will be interesting to some of the readers of the "Indian Agricultural Gazette" and I propose to give a short description of its cultivation as followed in Pergunnah *Lakhanpur*. Rice is a well known staple of the country and its botanical description is hardly necessary. I will merely mention a few of the important points of its cultivation. The crop is best grown in Bengal proper and elsewhere but still I suppose there may be some peculiar features of its cultivation in this part of the country which may interest some to know.

Varieties.] There are great many varieties of this crop, perhaps hundreds, grown in these districts and I intend to take a short notice only of a few of them. Indian cultivator knows great deal of agriculture but his knowledge is emperical and this fact is perhaps best exemplified by his blind adherence to these multitudinous varieties of rice. By experience he has found that some varieties grow well on certain kinds of soil and some do best in dry weather and some in wet. He has also ascertained that the same varieties even under equally favourable conditions succeed some years and fail in other years. But he has not reduced the number of these varieties by judicious selection and adaptation, developing the favorable features and peculiarities of the good varieties and discarding the indifferent ones. The principal varieties of paddy of those grown in these parts are :—

1. *Badshuh-pasund* which literally means liked by king, is a well known variety of paddy. It is the finest and much used for *polao*. This succeeds best on *kewal* soil or red *punkhi*. *Kewal* is the richest kind of soil in this division and it is chiefly clayey. It has many peculiar properties chief of which is its adhesiveness. Red *punkhi* is formed of deposit brought down from hills during the months of *Asarh* and *Sawan* (July and August).

2. *Bansphool* is a little larger in size than the above but has a peculiar fragrance of its own for which it is especially noticed. It succeeds best on *Kewal* and *Punkhi*.

3. *Jhingasar* has awns. The grain is long and stout. It grows well on *kewal* and red *punkhi*, but is quite unsuited for transplanting.

4. *Dussar* is coarse grained and succeeds equally on all kinds of soils.

5. *Mansara* has middle-sized grains, the color of paddy being reddish and of rice white. It grows on all soils. The chief peculiarity of this variety is that its *pales* open simultaneously when the ovaries are impregnated while those of all the other varieties open gradually These *pales* remain open from 2½ to 3 days and should there be rain during this time the ears would not fill.

6. *Sowa punkhi* has a green color when ripe, stout grain and suits Balthur and sandy soil.

7. *Russár* has long awned-grain, stout and very nutritious, suited for all kinds of soil.

8. *Gchumasar* gives heaviest crop, best suited for *kewal*, grain stout and suited for *morrhy* (parched rice). It satisfies hunger with comparatively less quantity than others.

9. *Horodhan* grows wild in ponds. It is easy of digestion and is given to the convalescent. Its rice sells 4 seers for a rupee. The crop is gathered by *Doomes* in baskets furnished with meshes.

10. *Hathia panjir* is about the hardiest variety of paddy known in these districts. It stands excessive moisture and is suited for hollows or lowlands. It is fit for elephants as its name signifies being coarse and unpalatable.

Kesore stands less moisture than the above but more dry-weather.

12. *Bhallasar* has a peculiar fragrance, and is very good to taste.

13. *Chand* has its husk or pales distinctly lined but has hardly anything to recommend it.

14. *Kurhena* can be sown and will produce a good crop when sowing time for the rest is gone.

15. *Jhonka* has awns, color of husk is rather black and so also of cleaned rice.

16. *Sáthee* ripens in 60 days and hence its name. This is called *purdanashin i. e.* its ears do not come out of the sheath. It remains ever covered and the unseasonable rainfall about impregnation-time troubles it not. *Sathee* is not grown much because it cannot stand much rain. It is generally grown on highland.

17. *Jaggernath bhog* has a peculiar smell. The grain is very small. It grows in clusters.

18. *Kalasar* has the peculiar property of ripening earlier than the other varieties.

19. *Mahpal* produces green rice and good to taste.

I have attempted a brief description of only a few of the varieties which have their characteristic peculiarities and points and I have no doubt from among these and other varieties a few can be produced which will be found to possess all the good points scattered in so many of them, but unhappily Indian cultivators are wanting in capacity to do this.

Sowing.] Astrology plays a prominent part in Indian agriculture as it did in England of old. An Indian cultivator blindly follows the astute astrologer who names the auspicious and inauspicious days for all the principal agricultural operations. Paddy is generally sown in the months of *Asarh* and *Sawans* and there are 4 *nuchhutters* during these months, two of which are auspicious. *Rohini*, the first one, is declared to be auspicious and it is said that paddy sown in this *nuchhutter* will produce some crop, no matter what may happen with the weather. The next *nuchhutter mrigashira* is inauspicious. *Adra* the third *nuchhutter* is again a good one. Should it be dry during this nuchhutter, gloomy will be the prospect of cultivators. In fact all paddy-sowing is done during this fortnight, for the next nuchhutter *pookh* is very inauspicious and a well known proverb "*mookh dai pookhna bowe*" puts the fact very forcibly. It says it would be better to put the seed in the mouth rather than in the soil. Experience has confirmed the truth of astrology and people are satisfied as to the inauspiciousness of *mrigasira* and *pookh* nuchhutters and do not wish to be told that one time is as good as the other, provided necessary conditions are fulfilled. In *pookh* seeds have two enemies, one in the shape of parrots and the other in that of ants and hence it is that *pookh*-sown paddy seldom comes to much. If the seeds be properly dressed in tar and blue vitriol and dried with sand or ashes, I have no doubt with favorable rainfall a full crop of paddy will be obtained. But people here accept facts and phenomena and seldom bother their heads with "whys" and "wherefores."

Ponurbus, *asres* and *singh* nuchhutters are declared to be auspicious for transplanting paddy. In *Kanee* this work should cease. The state of rainfall after this time is well described in a proverb which says "*Hath burse chitr murrâwa, girhust ghar baithe agrawe i. e.* when *Hathia* rains and *Chitra* roars, cultivator yawns at home, in other words, a good rainfall in *Hathia* nuchhutter and thunder in *Chitra* ensure a good crop to the cultivator. There is one variety known as *Namehra* which is not regulary sown but which springs in *Rohini* from seeds left on the field since the preceding year. This paddy produces good crops, better than even transplanted paddy. It is probably due to the seed having lain exposed to heat and dew for a few months on the soil and thus its vitality maintained; while seed kept for sowing loses some of its vitality by being stored. This mode of raising paddy crop is not much resorted to, simply because the seeds germinate earlier and it is difficult to keep cattle, which graze about this time unrestrained all over, off the *Namehra* paddy field. An earthen cooking pot with lime marks is generally perched on a bamboo pole to indicate that the land is to be treated for *Namehra* paddy, but this warning is not always attended to by cow-boys.

It has been found out by experience that, if sufficient room is allowed to seedlings in seed-beds, the transplanted paddy does better and also that if seedlings are raised earlier in the season, the crop is stronger and produces more grain. For this purpose some lands are artificially irrigated and otherwise prepared in Bysakh (May) as seed-beds so that the seedlings are ready to be transplanted as early as rainfall admits of the operation.

Seed-beds are sometimes manured with ashes and dung but for the crop itself manure is seldom used.

There are two distinct modes of sowing. First, seeds are sown broad-cast 15 to 20 seers per acre and ploughed in order to cover them in. This ploughing is technically called *bidha* in this part of the country, and it resembles in its action double mould board ploughing of England. When plants come above ground, rain-water is not allowed to escape from the field, and, when necessary, artificial irrigation is had recourse to. Second mode of sowing consists in broad-casting steeped seed on the surface of miry slush into which the land is previously worked.

Weeding.] At least one weeding by means of *bidha* ploughing is given to rice crop and this is done when plants are about a foot high. The weeds ordinarily found in paddy field are many, some of which would over-master the crop if neglected. Paddy fields are kept immersed in

water after the plants are a foot high with the object of keeping down weeds, for their seeds are thus prevented from germinating. As soon as the fields dry, weeds come out and would, if neglected, choke paddy plants.

Diseases and risks.] Thinly sown or transplanted paddy is liable to be blown down and if this should happen before the ears fill a poor crop will be the result. *Bhurki* is a blasting visitation which affects patches of paddy fields. These patches dry and wither and it is supposed this is due to the seeds sown in seed-beds being too much exposed to the sun. *Chihori* is a vernacular term applied to the injurious effect caused to paddy by westerly wind in Bhado. This wind is said to prevent the ears from filling. *Dharinga* or *Lohtana*, is a large sized green fly which appears in Kartic (October) and cuts the plants into two. This fly is probably called in the N. W. Provinces *Ganduki* or *tanki*.

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RAB.

(CONTINUED FROM THE LAST NUMBER.)

[Description of the Practice.]

THIS will be best illustrated by the notes of the experiments on progress.

Sites were selected, or approved by me after inspection, in 5 villages:—

1. Lonavli, Taluka Maval, Poona District.
2. Khadkala, Taluka Maval, Poona District.
3. Karjat, Taluka Karjat, Thana District.
4. Igatpuri, Taluka Igatpuri, Nasik District.
5. Chendli, Taluka Alibag, Kolaba District.

Experiments Nos. 1, 2 and 4 are in a locality where materials for rab are very scarce. Lonavli and Igatpuri are on the table-land of the Deccan, just over the ridge of the Bhor and Thal ghats respectively. Khadkala is 10 miles further inland than Lonavli. Karjat is just below the Bhor Ghat in the Konkan. Alibag is off the coast.

The Alibag experiment was entrusted to a native land-holder under the supervision of the Collector and District Forest Officer.

The object of the experiment is to test the comparative value of the various kinds of rab which are recognized by the people, and to determine in some measure whether, in the interests of forest conservancy, it is safe to insist on the use of materials less valuable to the country than brushwood for rab. Care has been taken in each locality to arrange the ingredients of the rab in the manner and in the proportion which local usage considered the most beneficial. Further, it has been most earnestly sought to make all conditions the same in each set of experimental plots, save and except the kind of rab.

LONAVLI.—A good site in land assessed by the Settlement Department at Rs. 2-8-6 per acre. The average assessment for rice land in this village is Rs. 2-12-0 (original survey). Local custom made it necessary to select the seed-bed in an elevated portion of the field, so that the seedlings might not be flooded during the early stages of growth. The average rainfall of this village for 16 years is 198 inches. Again local advice necessitated the use as seed beds of land so used for many years past to ensure the best results. This custom, it will be noticed, varies in different localities.

Cultivation.—The whole area was ploughed early in the reason. In March it was harrowed to break down the clods, and the upper surface of the land intended for seed-beds was dragged over with an implement called the "petara" to smooth the surface and to carry the upper layer to the embankment round the field. This operation was explained by the cultivators to be necessary. The seed-bed of one year must be freed from the used-up burnt layer of earth of the previous year. The petara was followed by a clod-crusher. The above may be taken to be the locally approved preparation of the seed-bed.

The next step was to select a portion of the old seed-bed and divide it into 7 plots each of ½ a guntha, with intervening spaces, and to spread the various kinds of rab.

Plot 1, *Leaf Rab*—

		Lbs.
(1) Layer of dead leaves	... ...	528
(2) Do. pit manure	... ...	325
(3) Do. light sifted earth	...	216

The second layer was to keep down the leaves and add fertility.

Plot 2, *Brushwood Rab*—

		Lbs.
(1) Ain lopping, fresh cut	... ...	680
(2) Coarse grass	... ...	277
(3) Bruised nachni straw	... ...	88
(4) Sifted earth and	... ...	360
Pit manure, mixed	... ...	270

Ain (Terminalia tomentosa) is considered the best brushwood for rab. The loppings were very carefully spread, and in order to make them lie evenly, a man with a bill-hook walked over the plot chopping projecting twigs.

Plot 3, *Cow-dung Rab*—

		Lbs.
(1)	Cow-dung	789
(2)	Coarse grass	128
(3)	Nachni straw	44
(4)	Mixed earth and	180
	Pit manure	135

The cow-dung collected in dry season, well dried and broken by hand into small irregular pieces about 2 inches in diameter, formed the bottom layer about 2" thick, just to cover the area of the seed-bed. This was spread by hand very carefully.

Plot 4, *Grass Rab*—

		Lbs.
(1)	Layer of coarse grass	354
(2)	Fine grass	153
(3)	Light sifted earth	800

Plot 5, *Brush-wood Rab*—

Cut bushes of the shrub called "fangal" considerded an inferior kind of brush-wood for rab—

		Lbs.
(1)	Fangal layer, fresh cut	687
(2)	Coarse grass	302
(3)	Straw	88
(4)	Earth and	360
	Pit manure, mixed	270

Plot 6, *Duplicate Cow-dung Rab Plot*—

		Lbs.
(1)	Cow-dung	805
(2)	Fine grass	132
(3)	Straw	44
(4)	Mixed earth and	180
	Pit manure	135

This differs slightly from plot No. 3. Instead of coarse grass, as recommended, I substituted fine grass.

Plot 7, *Unrabed Plot.*—Here I sought to make the best of the plot possible. I had it dug by pick a good foot deep. The rough clods lay to weather till the end of April. Then I spread 864 lbs. of pit manure. Before sowing, this plot was levelled by the hand-rake to break the clods and mix the manure with the soil.

In the arrangements above detailed I followed local experience as far as it would go. Leaf rab and grass rab are not practised, but in consultation with good cultivators I tried to utilise these materials to the best advantage. I would call attention to the fact that the people consider the amount of accessories required for the cow-dung variety of rab to be about half that for bushwood rab. I would record the patient care with which the various layers were spread. This is evinced by the very small differences in duplicate plots, *e. g.* the cow-dung spread in plot 6 only exceeded that put on plot 3 by 20 lbs., a marvellous approximation, seeing that the labourers understood nothing of the weighments being taken by me. The cow-dung rab as will be noticed is sometimes, though not at Lonavli, made without any accessories. The ryots explain the order of the layers thus. The main layer is placed next the smooth surface of the seed-bed. Over it grass is laid to cause complete combustion. But if the top layer of earth or pit manure is not provided, the grass will burn too quickly and leave the cow-dung or brushwood charred, not fully burnt. If the top layer is placed immediately on the coarse grass, there is a certainty of much of it falling between the interstices. Hence a layer of bruised nachni straw, or coarse rice husks, or some other substance which will keep the earth and grass layers separated during the burning, is required. The care with which this layer was put on was remarkable. It was switched with twigs to make it quite even, and in one case I saw water sprinkled over it before the earth layer was added. This is done, it is stated, unless the two top layers can be placed in position in the early morning when the dew is on the ground. The superincumbent layer of earth or pit manure also keeps down the mass during combustion and prevents it being blown about by the heavy winds. I must explain what I mean by pit manure. In the dry season all cow-dung collected is used as fuel and for other purposes, and what can be spared is kept for cow-dung rab. The droppings of cattle during the wet season are considered useless to form the main layer of this kind of rab. They are thrown into the manure pit attached to each house, together with house rubbish, ashes, mango stones, and all other refuse vegetable matter. There is no covering to these manure pits. The loss of soluble ingredients must be very great, for the pit has no concrete bottom or masonry sides. The ryots properly attach little value to it compared with the sun-dried cow-dung, which retains all its soluble matters, except those which are volatile, and for the ryots' purpose the volatile ingredients are unimportant, for they would at any rate be lost in the process of combustion. I have come to the conclusion that pit manure and earth are nearly equal in value for top layer. In this village they are customarily

mixed. I think I am correct, for I believe that the object of the layer is more mechanical than chemical and certainly the people do not attach much additional value to the pit manure.

As regards plots 1 and 4 local advice was that I should mix the grass and leaves, in fact that I should make leaf rab, with grass as an accessory. I followed this advice in other experiments, but did not this case in order that I might judge of the value of grass alone. I added a goodly layer of pit manure to the leal rab (plot 1) as I had it by me and to test in some degree its manurial value. In the unrabed plot (No. 7) the addition of a heavy layer of pit manure was similarly designed. It would have been better if I had put an equal weight of cow-dung to that put on plots 3 and 6. But it was difficult to obtain it. This modification was admitted in the Khadkala plots so as to judge of the exact effects of the burning.

KHADKALA.—Site chosen on land assessed at Rs. 1-12-0 per acre. The average rainfall for 20 years is 68 inches. The average assessment on rice land amounts to Rs. 2-2-7. So that the site chosen is under the average as is evidenced by the fact to be noticed that only Sal, a coarse variety of rice, is grown on it. It may here be remarked that the classification of rice lands at this, the original survey, was largely based on the particular kinds of rice grown upon the land, this being considered as one of the best characteristics for determining its cla. : The Lonavli land thus grows a fine variety-ambemor. It may be accepted that the character of the land, its depth of soil, position, and water facilities determine the kind of rice rather than the character of the rab.

At Khadkala duplicate plots of cow-dung, ain loppings, and fangal were prepared. In addition I made a grass rab plot with leaves as an accessory. As to the amounts of the ingredient, character of the layer and the like, I was guided by local advice.

Cow-dung—Plots Nos. 1 and 5—

	Lbs.
(1) Cow-dung layer	336
(2) Coarse grass	648
(3) Nachni straw, &c.	384
(4) Earth and pit manure mixed (plot I).	170
Do. do. (plot V).	192

Ain Rab—Plots 2 and 6—

	Lbs.
(1) Ain loppings, dried...	312
(2) Coarse grass	648
(3) Fine straw, &c.	384
(4) Earth and pit manure (plot 2) ...	438
Do. do. (plot 6) ...	390

Fangal Rab—Plots 3 and 7—

	Lbs.
(1) Fangal, dried	240
(2) Coarse grass	684
(3) Straw, &c.	384
(4) Earth and pit manure (plot 3)	390
Do. do. (plot 7)	348

Leaf Rab—Plot 4—

	Lbs.
(1) Coarse grass	216
(2) Leaves	168

Plot 8 was not rabed. It was dug over with the pick as at Lonávli and allowed to weather and was supplied with 336 lbs. of cow-dung, *viz*, the exact amount put on plots 1 and 5, *but the manure was not burnt*. It was levelled before sowing.

The cultivation of all the plots was similar to that at Lonavli, The seed-beds are customary seed-beds.

The first points to be noticed are the large proportion of grass in the cow-dung and brushwood plots and small amount of cow-dung used in comparison with Lonavli. The difference in the weights of the brushwood is due chiefly to the fact that the weighments were made after the loppings had dried. The third layer differs slightly in the two villages. In Khadkala it is a mixture of bruised straw with the leavings of the cattle, stubble, and other light rubbish, but the object is the same and the effect not far different. The The villagers do not make grass and leaf rab, and in this case decided that it did not require the the earth layer. If my opinion is correct, theirs is wrong. I was not able to be present at the stage to prevent the neglect as it appears to me.

In this village I added three other plots which I will style in the native way :—

Plot	9	Kachcha rab.
Do.	10	Moda „
Do.	11	Ute „

These are quasi rabs, if I may use the expression. They are substitutes for ordinary rab and require somewhat minute description. Their prominent characteristic is that the ingredients are not burned.

Moda Rab: Moda = germinaton.

It is a system of sowing seed, the partial germination of which has been artificially caused. This is done as follows ;—A wicker basket is lined with

rice straw and then daubed inside with cow-dung moistened with warm water. The mixture is of such a consistency that it will lie against the rice straw lining. The seed is poured in and covered with another layer of rice straw. Water is from time to time poured on for 5 or 6 days, by which time the germination is considered to be sufficiently advanced. This is one method, but I have come across several variations in other places. In some cases warm water, and in others boiling water is poured on the mass of seed in the basket. Where the ryot is anxious to get the seed ready quickly he appears to use hot water. The seed-bed is also specially prepared. Land close to the village site, which is enriched by the drainage from the houses, is considered requisite. The site is ploughed early or else after the ante-monsoon showers have fallen. When the heavy rains come the water is banked in to cover the area as deeply as possible. After a few days the water is drained off, and the land is again ploughed, and levelled with the long harrow. Then the germinated seed is sown broad-cast very carefully. It falls on a soft muddy bed and is left as it falls. Any covering it up would injure the plumules. The seed-bed has to be watched against the depredation of birds till the seed has taken good root. The necessity of adapting the growing season of the plant to the duration of the rains explains the object of causing artificially partial germination. This system is risky. If the rain does not come as it is wanted, the germination proceeds too far, and the ryot says the seedlings grow up crooked. This is no doubt a wrong explanation. But whatever the right one is, the fact remains that experience teaches the necessity of sowing the seed at a certain stage. At Igatpuri this year the rain held off. I saw a farmer sow his germinated seedlings on an almost dry bed. He complained bitterly. He said he could not wait as his " Moda " was already 4 days old and it would be worse to wait for the rains. It is stated everywhere that the yield for Moda seedlings is inferior and the cost and the difficulty of weeding great. Moda rab is chiefly resorted to when the seedlings from the rabed seed-beds are killed by excessive flooding.

Kachcha Rab.—This system, which is more common at other places, Igatpuri for instance, than in the Maval Taluka, consists in raising seedlings in seed-beds richly manured by folding sheep for several nights closely packed together. In the opinion of the people, heavy manuring with cow-dung will not do the work of sheep-folding, because they say in the latter system the urine of the sheep is secured as a fertilizer and the droppings are richer; and they are right. As the description given above of the method of preserving cow-dung will suffice to prove, kachcha rab is held in low estimation. It does not, the ryots say, keep down weeds. In plot No. 9, 20 sheep were folded for 7 successive nights.

Ute Rab is very similar to Kachcha rab. I am now convinced that it is only a variety. The only difference is that the seed-bed is fertilized by village drainings as in the case of Moda rab and not by sheep-folding. It is risky. If the sowing of the seed is followed by heavy and prolonged rains it is washed away. Its practice is very restricted. Enquiry shows that the people only resort to it when their ordinary rab is insufficient. It is stated not to succeed on land naturally damp, either from the existence of underground springs or otherwise. It does not succeed in black soil. In both these cases the reason alleged is the impossibility of keeping down weeds. It will not do in sandy soil, because that is too poor. In Khadkala I selected sites for Moda and Ute rab in a field close to the village site. For the variety of Ute, which I have here styled Kachcha rab; a plot adjoining the set of seed-beds above referred to was found. In Igatpuri Kachcha rab and Ute rab are respectively styled Korad Ute and Chikal Ute, *i. e.*, dry Ute and mud Ute. The former is also there called kachcha or hirwa, *i. e.*, unburnt rab.

IGATPURI.—The site selected is on land assessed at Rs. 1-8-3 per acre. The average assessment on rice land was under the old survey settlement Rs. 3-1-2 per acre. The revised settlement has just been introduced. The average assessment for rice land in this village is under it reduced to Rs. 2-8 per acre. The average rainfall for 5 years is 125 inches. The site has, however, been considerably improved by private expenditure. For several years past, it has been used as a seed-bed for kachcha rab, *i. e.*, sheep have been regularly folded. Its fertility has no doubt been greatly increased. As all the plots are contiguous one with other, all share alike the advantage of this increased fertility. In Igatpuri it considered best to change the seed-bed from year to year. But the requirements of the seed-bed, elevated position, proximity to village and the like, have resulted in infringement of the recognized principle with regard to rice land, though it is maintained in respect of seed-beds on the uplands for nachni and vari. The principle is however not considered applicable to seed-bed for kachcha rab because the continuous use of the fertilizing qualities of sheep-droppings raises the fertility of land which is essential this in system.

I made a personal inspection in this village in order to ascertain the proportion in which the various kinds of rab are actually used. I measured all the seed-beds in number with the following result:—

	Rice Land		Nagli Land		Vari Land	
	Area of Seed-bed		Area of Seed-bed		Area of Seed-bed	
	A.	g.	A.	g.	A.	g.
(1) Cow-dung rab	1	22	0	32	0	0½
(2) Brushwood rab	0	19	1	20	0	6
(3) Leaf and grass rab	0	4	0	10	0	7
(4) Korad Ute rab	16	37	...	...	...	...
(5) Chikal Ute rab	3	20	...	...	...	...
(6) Pit manure rab	0	31	0	20	0	11
(7) Unrabed ...	0	2	...	...	0	0½
Total ...	23	15	3	2	0	25

This result is instructive. It shows the very low proportion of seed-bed for which cow-dung with its multifarious purposes is available. The people insist that the substitutes of Ute are useless for nachni and vari and so the inspection showed. It shows too how deficient the supply of combustible materials in this village is. Only 8½ per cent of the rice area of seed-bed was rabed with approved materials. The 4 gunthas of leaf and grass rab and the 2 gunthas unrabed were those experimentally tried on my selected sites. Pit manure to a certain extent is used as rab alone, but this is the result of inability to secure other material. In Lonavli a similar inspection not made personally however showed the seed-bed areas for rice lands thus :—

		A.	g.
1.	Cow-dung rab	3	10
2.	Brushwood	7	0
3.	Cow-dung and brushwood, mixed	0	33
	Total ...	11	3

This is not a full record of the seed-beds. At the time of the inspection there were no means of ascertaining the area of seed-bed under substitutes: but one fact is evident again that cow-dung supplies a very small proportion of the rab materials.

To proceed with the description of the Igatpuri experiments. The custom here is strictly to avoid ploughing the seed-bed. One or two of the leading cultivators admitted that it might be better to plough it but urged that the ryots have no leisure to plough till the ground becomes so hard as to make it impossible.

I made the plots one guntha each as there was land available; but for the sake of comparison I will reduce the figures proportionately; 12 plots were arranged as follows :—

Cow-dung rab.—Plots Nos. 1 and 6.

	Lbs.
Cow-dung layer alone	666

Brush-wood rab, Fangal.—Plots Nos. 2 and 5.

	Lbs.
(1) Fangal bushes	490 after drying 12 days.
(2) Grass layer	61
(3) Pit manure	221

Brush wood rab, Fangal.—Plots Nos. 3 and 4.

	Lbs.
(1) Fangal bushes	490
(2) Grass layer	68
(3) Light sifted earth ..	356

Kachcha rab.—Plots Nos. 7 and 10.

75 sheep folded on each plot for 4 nights.

Leaf rab.—Plots Nos. 8 and 11.

	Lbs.
(1) Dead leaves one foot layer	352
(2) Grass layer of 3 inches	378
(3) Light sifted earth	356

No rab.—Plots Nos. 9 and 12—Dug with the pick one foot deep, clods broken with small mallets (mogri) harrowed down and levelled with paudas.

The cow-dung rab has no accessories here by custom, regulated no doubt by other demands for grass. The amount is intermediate between that used at Lonavli and Khadkala. The same remark applies to brushwood. I had no ain plot, because according to the opinion of the District Forest Officer ain loppings made at so late a date in the season are not at their best. Their leaves are shed. They are I may add too woody. No doubt to a great extent this objection applies to the other villages, and the superiority of ain will not perhaps be evidenced by the experiments in progress. According to the people's notions the loppings should be made early in the season and brought on to the seed-bed at once to secure the best results. This remark, I wish to urge, is not made in the light of results as far as at present disclosed. It was recorded in the notes taken long before the transplantation of the seedlings was made. Instead, therefore, of using ain I prepared 4 common brushwood plots. In one pair I used sifted earth as the top layer, in the other pair pit manure. As all other conditions are the same this experiment will throw

light on the comparative value of pit manure and earth as the top layer.

The correspondence in the weight of ingredients in various plots seems to require an explanation. Instead of weighing each basket or load, test weighments were taken and the total entered according to the number of baskets or head-loads. In Lonavli I weighed everything separately except the earth and pit manure, but I thougt it unnecessary to order this to be done elsewhere.

KARJAT.—An excellent site was secured. The land is Government property. Its usufruct yearly is sold by auction. But as the sale takes place late in the season the land has never been used as a rabed seed-bed. The assessment is Rs. 4-1 per acre. The average assessment on rice land in the village is Rs. 3-4-0 under the original settlement yet in force. The land is valuable. This year the right to cultivate it sold for Rs. 14. per acre. It has fetched on the average for 10 year just over three times its assessment yearly. At Karjat the rainfall is heavy. The average of 20 years is 115 inches. In 1878 the fall was 170 inches, in 1871 as low as 79 inches.

The experimental seed beds were by error made only ½ guntha each, but I shall double the figures for the sake of comparison. The seed-bed is kept unchanged from year to year. After the crop is off, the stubble is weeded out by the hand-weeder and it is left unploughed and unharrowed till the rab materials are spread. The Lonavli cultivator appears to be advanced in comparison.

The plots were as follows :—

Cow-dung rab.—Plots 3 and 9.

	Lbs.
(1) Layer of fresh cow-dung ...	1,444
(2) Grass	736
(3) Light earth	432

Ain rab.—Plots 1 and 7

	Lbs.
(1) Ain loppings, dry	680
(2) Grass	736
(3) Light earth	864

Fangal Rab.—Plots 2 and 8.

	Lbs.
(1) Fangal, dry	680
(2) Grass	736
(3) Light earth	864

Leaf Rab.—Plots 4 and 10.

	Lbs.
(1) Layer of dead leaves 2" deep ...	Weight not taken
(2) Grass	1,114
(3) Earth	864

Euphorbia Rab.—Plots 5 and 11

	Lbs.
(1) Euphorbia, fresh cut	2240
(2) Grass	736
(3) Earth	864

No rab.—Plots 6 and 12.

Dug one foot deep with pick.

The cow-dung was put on fresh and daubed over the surface of the seed-bed. The weight is therefore high. This is customary when fresh dung is used. If old dung, then the practice at Lonavli holds. It is noteworthy that the 3rd layer of rice husks or nachni straw is absent. This is chiefly owing to the fact that the grass used is not so coarse as elsewhere. It was however very carefully laid and is beaten down with a long bamboo pole tapering at one end. This pole is 20 feet long. The length is to prevent the necessity of the beater's standing on the spread materials.

The ain loppings are customarily made early in the season and left to dry in large heaps. They lose in weight and are more easily transported to the seed-beds. The weight of brushwood, taken, as it was, well dried, is noticeable. It is much more plentiful in Karjat than, for instance, at Khadkala, and the customary proportion is higher in consequence.

The leaf rab was unavoidably deficient. Leaves were not to be obtained in such quantity as the people consider adequate. Therefore the amount of grass was largely increased.

A new element has been introduced in this set of experiments, *viz.*, the utilization of the Euphorbia (E. nerifolia) which grows freely though slowly in districts of heavy rainfall. The people say that Euphorbia takes two years to dry sufficiently. I covered the seed-bed thickly with it and left it to dry. It shrank so that more had to be added to cover the surface. This material has been used this year by a few ryots at Karjat, simply because the railway hedge has been cut down and replaced by a wire fence. I believe it is regularly used in places but I have not seen it except under exceptional circumstances.

As regards the Alibag experiment I have received no information yet, but there are special features connected with it which merit notice.

The following varieties of rab are being experimented with :—

1. Cow-dung rab,
2. Superior brushwood rab,
3. Inferior brushwood rab,
4. Leaf rab,
5. Grass rab,
6. Tus (husks of rice, nachni),
7. Pend (oilcake, the residue after the expression of oil from seeds unfit for cattle food),
8. Kuta (dried fish),

and there is the unrabed plot.

In this district rice is grown in sweet land and on land reclaimed from the sea which retains a large percentage of salt. In the latter rab is not used, but sprouted seedlings are sown as in the Ute system described above. The germinaton is caused in two ways. The seed is put into baskets lined with rice straw and teak leaves and exposed to the rain for 24 hours. Then the seed is exposed to the sun till it germinates, or, if there is no sun, is treated with warm water, or else the seed mixed with rice straw is placed in a hole in the field till it germinates.

The customs, as ascertained by inquiry in Alibag with regard to the recognized systems of rab, differ very little indeed from those described.

Cow-dung rab has the accessories of coarse and then fine grass and lastly earth. Brushwood rab is similarly prepared, the brushwood replacing the cow-dung.

The specialities of Alibag are curious.

Rice husk rab (Tus rab) is formed of a layer of grass about 1 span thick, covered with a similar layer of rice husks.

Oil-cake rab.—Oil-cake edible by cattle could not be spared for rab purposes.

Fish rab, Kuta, literally fish dried and pounded.—These quasi rabs are chiefly used as manures to seed sown in the seed-bed of the year before, which is considered sufficiently free from weeds to permit the seed to grow well. They are no doubt varieties of kachcha rab customary where the materials can be procured, and taking the place of the sheep-folding elsewhere.

I have now described the preliminary arrangements for the experimentt. The next stage was the firing of the plots. I was only present at one place—Lonavli—for the burning. The Lonavli and Khadkala plots were fired at the beginning of April at noon; the Karjat plots at 9 A.M., a fortnight later, and the Igatpuri plots about the same time at noon. The time of day, considered best, varies in places. The people say that the plots should be fired in the still morning before the wind gets up. This appears to be in unsheltered situations. In others it is customary to wait till the wind is strong. The plots are fired at the end furthest from the wind, so that the burning may go on against the wind.

In one place the time taken in the burning was recorded. Grass and leaf rab burnt in 45 minutes; fangal rab in 1 hour 10 minutes; ain rab in 1 hour 35 minutes, and cow-dung rab in 1 hour and 25 minutes. In each place the burning was complete except in that of leaf rab and Euphorbia rab where charred remnants remained. I tried to collect samples of the burnt soil but they were unsatisfactory. The appearance of the well-burnt plots was however very different from that of the others. In the former the burning reduced the upper layer perhaps half an inch deep to an impalpable brick dust. In the latter the colour of the upper layer was hardly changed beyond the necessary colouring from the top layer of earth fallen down.

The plots were left untouched after the burning till the rain came.

Plots	Date of sowing	Kind of Rice sown	REMARKS
Khadkala...	31st May ...	Sal ...	An inferior variety
Lonavli ...	1st June ...	Ambemor	One of the best kinds
Karjat ...	14th " ...	Kolamba	A very good variety
Igatpuri ...	14th and 15th June	Sakhwar	A fair variety

Rate of seeding.—I desired that the rate should be fixed by a jury of ryots and all plots sown at one rate in each set of experiments. But local opinion was strong against this plan in 2 places:—

Khadkala.—8 lbs. per ½ gunthas.
Lonavli.— 6½ " " "
Igatpuri.— 5½ " " " of unburnt plots.
6 " " " of burnt plots.
Karjat.— 4 " " " cow-dung rab.
4¾ " " " ain rab.

		lbs. per ¼ guntha.	
Karjat.—5½	,,	,,	,, Fangal, Euphorbia and grass and leaf rab.
6½	,,	,,	,, unrabed plot.

At Igatpuri the seed was less on the unburnt plots. In Karjat it was more. The custom in each case was clearly ascertained. In Karjat the explanation is that the better the rab the less the seed needed in the seed-bed. In Igatpuri, on the other hand, it is argued that with less manure the plot cannot feed so many seedlings properly, and therefore the seeding should be lower for poor rab. The object at Karjat was to sow such amounts as would transplant the same area, and, as will be seen, the object was extraordinarily accurately secured in the case of varieties of rab practised by the people.

The seed was sown by hand at Khadkala and harrowed in. The bed was then raked by the hand-rake. At the other places the seed was ploughed in, the reason alleged being the difference of soil. The hand-rake, *datale*, was used to smooth the surface. At Karjat the hand-rake has a handle 20 feet long. The larger seeding at Khadkala is due to the smaller rainfall. In the Moda plot at Khadkala the seed was sown on the mud bed and left as sown.

I visited the Lonavli, Karjat and Igatpuri plots after the seed had had a good start to record the differences in appearance.

I saw the Lonavli plots on 23rd June, 23 days after sowing. The cow-dung plots Nos. 3 and 6 were the thickest, highest, most even, and the colour of the seedlings was a dark-green. In appearance the brushwood plots 2 and 5 came next, though in plot 5, 3 places about one foot square each, have been eaten by crabs. Plot 4, grass rab, was better in colour and thickness than plot 1 (leaf rab). In the latter the seedlings were thin and yellowish. Plot 7, unrabed, looked far inferior in every respect. An experienced survey officer, without information as to the character of the rab on each plot, placed them in the above order. I saw these plots again a week later, when His Excellency the Governor visited them. The differences were accentuated.

Karjat.—The sowings were made on the 14th June. I saw the plots on the 23rd June and 10th July. The order, as far as could be judged by appearance, was exactly the same as at Lonavli.

Igatpuri.—Sown on 14th and 15th June. I saw the plots on the 30th. Again the cow-dung-rabed plots were far superior in colour, thickness and regularity. Next to them, however, contrary to the appearances at Karjat and Lonavli the grass and leaf plots appeared better than the brushwood plots, though the difference was not marked. Far behind came the kachcha rab plots, and these were very little to be preferred to those without rab or fertilizing sheep-dung this year. But I must call recollection to the fact that the only difference between these plots is that the kachcha rab plots have received sheep-dung this year only more than the unrabed ones. In the rest of the field sown by the owner with kachcha rab, though sown on the same day, the appearance was poorer than in any of the experimental plots.

Transplantation.—The rains held off in Igatpuri and Khadkala after the sowing. In Karjat they came with greater regularity. The result is that the seedlings in Karjat were ready soonest :—

Locality.	Days elapsing between sowing and transplantation.	REMARKS.
Khadkala...	49 days	
Lonavli ...	39 do.	
Karjat ...	26 do. ...	All but Euphorbia and unrabed plots.
	34 do. ...	Euphorbia and unrabed plots.
Igatpuri ...	39 do. ...	

In this point the statement which I have previously made that the better the rab the sooner the seedlings are ready for transplantation was only fully verified in the case of Karjat, but it was here only that the rainfall was normal though late.

I have now come to the stage where the first important result disclosed itself, *viz.*, the comparative area of transplantation of seedlings raised with different varieties of rab.

As stated, it was my desire that the seeding should be the same throughtout each set of plots. This was infringed in a slight degree at Igatpuri, but totally at Karjat, but the error, if error it may be called, has been instructive, and tends to show (and I would note that this point was not clearly elicited by enquiry) that the area of transplantation can be to a certain extent equalized for all varieties of rab by varying the amount of seed sown. But in other words, however, the principle was elicited, *viz.*, that the poorer the rab the greater the amount of seed required to produce seedlings to plant out an acre.

The following table shows the results in a convenient form :—

No.	Variety of Rab.	Area planted out from the Seed-beds taken As ½ Guntha each									
		Khadkala		Lonavli		Igatpuri		Karjat			
								A.		B.	
		G.	a.	G.	a.	G.	a.	G.	a.	G.	a.
1	Cow-dung rab	2	11	3	12	3	7	4	0	4	0
2	Do. duplicate plot	2	11	4	6	2	10	3	9	3	9
3	Ain rab	2	2	2	14	...		2	14	2	5
4	Do. duplicate	2	4	...		...		3	13	3	1
5	Fangal rab	2	2	3	6	1	11	3	11	2	11
6	Do. duplicate	2	0	...		1	14	3	8	2	9
7	Do. triplicate	...		...		1	4	...		...	
8	Do. quadruplicate	...		...		1	9	...		...	
9	Leaf and grass	1	7	...		2	9	3	4	2	6
10	Do. duplicate	...		...		2	2	3	12	2	12
11	Leaf with pit manure	...		2	3	...		...		...	
12	Leaf alone	...		...		...		...		...	
13	Grass alone	...		2	12	...		...		...	
14	Euphorbia rab	...		...		...		2	8	1	14
15	Do. duplicate	...		...		...		2	8	1	14
16	Kachcha rab	1	0	...		1	6	...		...	
17	Do. duplicate	...		...		1	8	...		...	
18	No rab but pit manure	...		1	8	...		...		...	
19	No rab but cow-dung	1	8	...		...		...		...	
20	No rab nor manure	...		...		1	1	1	8	0	14
21	Do. duplicate	...		...		1	0	1	10	1	0

KARJAT.—A. shows the actual area of transplantation; B. the area which would probably have been planted out if the seed had been equal for each plot in amount.

IGATPURI.—First two fangal plots with pit manure alone. Second two with earth only.

I withhold my opinion as to what deductions may be drawn from these first results till after harvest the full results are konwn. A study of the table will, however, I think, show that it may safely be deduced—

(1) that cowdung rab is decidedly superior to all other varieties, and that the better the soil and the better the season, the more is its superiority exhibited,

(2) that plots unrabed and unmanured are markedly inferior, not only to rabed plots but to manured unrabed plots,

(3) that manure unburnt is much inferior, as far at any rate as regards the area of transplantation, to manure burnt,

(4) that good results are obtained from leaf and grass rab. These results are much better than I anticipated, but here I must notice that the brushwood used for the ain and fangal plots was not cut early, as the people consider necessary. This fact

may also account for the small supiriority, nay in cases inferiority, of ain as compared with fangal.

As regards the Moda and Ute plots at Khadkala, the area of transplantation was respectively only 2 *as.* and 7 *as.* In fact these varieties were a failure. I have explained above that both are risky and the results have verified the statement. In both cases the seed-beds, shortly after sowing, were washed over by very heavy rain before the seed had taken root. Only a small number of seedlings was saved.

I append a statement which affords some evidence as to the proportion of seed-bed, amount of seed, the weight of materials per acre, required for each variety of rab, as deduced from the trials.

APPENDIX.

Table showing the Proportoin of Seed-bed per Acre as deduced from the experiments, together with the Amount of Seed and the Weight of the Principal Materials, as calculated from the ascertained proportion of Seed-bed, required to produce seedlings to plant one acre.

No.	Varieties of Rab.	Average per Acre of Rice.				Remarks.
		Proportion of Seed-bed.	Seed.	Weight of the Principal Materials.	Weight of Dried Grass.	
1	2	3	4	5	6	7
	A.—*Burnt.*	Gunthas.	Lbs.	Tons (2,240lbs.)	Tons (2,240 lb)	
1	Cow-dung rab ...	5·89	71·62	Cow-dung, dried ... 3·15 Do. fresh . 7·59	2·66	Column 5 average of 6 plots Do. 2 do.
2	Ain rab	7·92	100·58	Ain, dried . 3·51 Do. fresh ... 4·81	4·31	Do. 4 do. Do. 1 do.
3	Fangal rab	9·41	119·50	Fangal, dried ... 3·99 Do. fresh . 5·77	3·19	Do. 8 do. Do. 1 do.
4	Leaf and grass ...	8·88	113·66	Leaves ... 2·31 Grass ... 5·08	5·08	Do. 5 do.
5	Leaf with pit manure	9·14	115·16	Leaves ... 4·31 Pit manure 2·65	......	Do. 1 do.
6	Grass (alone) ...	7·27	91·60	Grass ... 3·29	3·29	Do. 1 do.
7	Euphorbia	10·66	111·93	Euphorbia, fresh ...21·32	7·005	Do. 2 do
	B.—*Unburnt.*					
8	Kacha rab	15·48	208·98	7,637 sheep for one night.	......	Do. 3 do.
9	No rab but pit manure	13·33	167·95	Pit manure 10·28	......	Do. 1 do.
10	No rab but cow-dung	13·33	213·28	Cowdung... 3·99	......	Do. 1 do.
11	No rab nor manure	20·81	243·72	... ..	......	....

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BURMESE RICE MEASURES

AND RICE STATISTICS.

The necessity for compulsory action on the part of the executive for unifying the various standards used in Burma in connection with the Trade in Rice, will be acknowledged when the inconvenience occasioned by the great diversity that now prevails is fully explained. There are no legal weights and measures in the country other than those of India, which have not been adopted and are not recognized as current anywhere in the Province. Rice being the staple of Burma, the attention of the local authorities would appear to have been first directed towards regulating the capacity of the "basket" which here served the purposes of the English bushel in the grain market. Rules were prescribed fixing the size of this measure, which was expected to secure uniformity from Prome to Tavoy and Akayab to Shwegyn. These regulations were, however, more honored in the breach than the observance, and the outcome is confusion worse confounded. The "basket" varies in different places, and different baskets obtain in the same place at the same time. The last state in this respect is, in fact, worse than the first. But so long as the inconvenience did not affect Government interests, the necessity for legislative action did not appear imperative. But now that the State Railways find the difficulty of the difference in standards in their Traffic working, inquiries are instituted with view of definite and final settlement. The importance of the vast interests involved may be inferred from the fact that there are now over 3½ millions of acres under rice in the Province, and that this paddy-land is more than 88 per cent. of the cultivated revenue paying area, which is steadily increasing at the rate of 100,000 acres per annum. The total yield of these rice lands of British Burma is, according to the Administration Report for 1883-84, in an average year, about 2,615,930 tons of paddy, equal to 1,935,788 tons of cargo-rice. The total requirements of the Province for home consumption having been estimated at 947 000 tons leave a balance of 988,000 tons available for export. It may, therefore, be safely laid down as the rule for ordinary years, that, a-half of the whole crop is the exportable surplus. But, as under exceptional conditions, the export of rice has been known to reach nearly 1,100,000 tons, in a single year—1882, the necessity of controlling such a large trade by a commercial basis or fixed unit of measure will be now obvious, particularly as there is a constant and preferential demand for Burman rice in the markets of the world. British Burma is practically able to export as much rice as all the other rice exporting countries in the East together, and it is worthy of note that Saigaon and Bangkok rice fetches in Europe 25 per cent. less than Burma rice. Furthermore, comparatively very little of the Bengal, Saigaon, and Bangkok rice goes to Europe, while nearly all, certainly upwards of three-fourths, of the Burman rice is shipped to European markets. A surprising feature in these comparisons is the fact that the rice exports of Bengal show a tendency to decrease rather than increase. Saigaon has only since 1884 commenced to export rice to Europe, which accounts for France taking only 1000 tons from Burma in that year. No Burman rice is exported to either Australia or New Zealand, possibly due to the unique import-duty of 3*d*. per pound levied with the object of stopping Chinese immigration. It is satisfactory to learn that although the export duty of 4½*d*. per maund equal to 10½*s* per ton, add 6¼ per cent. to the price of milled cargo-rice, still the rice merchants of Burma are not pressing for the abolition of the duty. The average yield of rice in the husk (paddy) is computed at 32 baskets (1600 lbs.) per acre; and as the selling-price of paddy in the villages last season averaged about 7*s*. per hundred baskets, while the Government demand for land-revenue was under 4*s*. per acre, the difference goes to show a rather handsome margin of profit to the cultivator. Hence, the people of Burma are, as a rule, much better off than those of India. The extent of these transactions in the chief staple of the Province coupled with the obvious disadvantages of having different rice measures in use, makes it desirable that the vexed question of the Burmese rice-basket should be disposed of at once and for all.

AUS DHAN

OR AUTUMN-RICE.

[In parts of 24-Pergunnahs.]

It is not to be supposed that the following information respecting the cultivation of the *Aus-Dhan* gives the details of such cultivation for the whole of Bengal, or even of a whole district. The article is the result of a series of information collected by the writer from a large number of his own ryots selected from different parts of an area nearly 400 sq. miles, corroborated by his trustworthy *Gomastas* (agents), some of whom are themselves Munduls and farmers of good position, and finally supplemented by his own observation.

Rice, the staple food grain of Bengal, is primarily divisible into two classes—the *Aus* and *Amun*. The former is a coarse variety, eaten by the lower

classes alone, and entails, in its cultivation, much less risk and trouble on the peasant than the *Amun* or the fine variety. We shall limit ourselves, in this article, to the cultivation of the *Aus* variety.

The *Aus* grows in all varieties of soils except the very low-lying ones which receive the drainage of the surrounding lands and in which water collects during the rains. High land receiving a lot of water but not retaining it for a long time is however the very best for it.

Varieties.] The *Aus* has innumerable varieties, differing not so much in appearance or quality as in euphonious poetical names by which they are always distinguished. Some of the chief are :—*Surjamoni*, *Parangi*, *Royay*, *Aus-beree*, *Foolcar*, *Kapeleswar*, *Tulsi-sal*, *Fampree*, etc. Of these, the first, second, seventh and eighth varieties delight in high sandy soils while the third, fourth, fifth and sixth in comparatively low hard or compact soil.

Rotation.] *Aus* in the majority of cases follows *Aus*, in some cases, jute. It is known to most farmers that it gives the best yield after jute. Peas, lentils or other pulses are sometimes sown on Aus-land soon after the harvesting of the *Aus*-crop. No systematic rotation is however followed.

Manures.] Cow-dung, earth, ashes and various other refuse-matter, such as dead leaves, house-sweepings and, in fact, any and everything that the farmer can lay hold of, are heaped together either at a corner of the house or outside it. Cows' urine is however seldom utilised in this way, the arrangements for storing cow-dung rendering it impossible. The heap is always exposed to the action of wind and water but is seldom turned and it is not unknown to some peasants that the land which receives the drainage from the heap is very fertile. This heap—the farm-yard-manure heap of our peasants,—is carted on to the Aus-fields and spread there by the hand. The quantity used varies from half a cart-load as in the case of the poor peasant who has to buy it, to two and sometimes three cart-loads per bigha.* One cart-load of the manure varies in weight from 12 to 14 maunds according as it is ill or well prepared. One man usually spreads it over about three bighas (an acre) a day. It takes him nearly two hours to do a bigha. Well-to-do farmers supply labourers for this purpose.

The value of such manure is estimated locally at about 1½ to 2 annas per maund. No other manure of any kind whatever is used.

* A bigha = one-third acre.

Ploughing.] The stubbles of the previous crop are all turned in, either immediately after harvesting or, what is not so good, in *Falgoon* (February) when the ploughings commence. The hours of ploughing are from 7 A.M. to 12 in the noon, (5 hours in all). The peasant cannot plough in the evening as he has to feed himself and his cattle then and do other small job for his household. One man and a pair of bullocks will do one bigha in five hours.

About 6 ploughings are necessary to prepare the land thoroughly. These are all finished in 2 months. If the first be begun in *Falgoon* as is often done, the last is finished by the end of *Chaitra*. The several ploughings run in different direction. The intervals between these ploughings are long or short according as the growth of grass on the ploughed up land is slow or fast. The peasant knows that even with all these ploughings and cross-ploughings, he seldom gets the requisite amount of tilth, for with his best plough and his best beasts, the depth of the ploughing seldom exceeds 3 inches or at best 4. He knows however the deeper his plough goes the better it is for him.

The plough in Bengal hardly turns up a furrow ; it merely scratches the ground in the same manner though not so efficiently as the English grubber or the cultivator. No wonder then that the poor peasant sometimes complains of the inefficiency of the plough.

Clod-crushing and rolling.] This is done with what is known as the *Mai* or *Banshui*—a singular piece of machinery of the form of an ordinary bamboo ladder. If there are a few large clods or a plenty of small ones after the ploughing has been finished, it is necessary to draw this piece of apparatus over the land once or twice before sowing. But this necessity seldom arises and rolling is done usually after sowing. Twice rolling is usually enough. Generally it takes about half an hour for a man and a couple of bullocks to do one bigha.

Sowing.] This is always done by *broad-casting* from the latter end of *Chaitra* (April) till the end of *Baishakh* (May), immediately after the land has been wetted by a shower of rain. One man can sow one bigha easily in a quarter of an hour's time. The seeds are usually one's own, and seldom bought. The price of such seed is *always* 1¼ times the selling price. The quantity sown seldom exceeds 6 to 8 As. in value.

All these operations however, from ploughing down to sowing, are sometimes done by hiring or borrowing. The hiring of a plough with the owner's

man and beasts to do the work costs from 5 to 6 As. per day.

If a lot of grass and other weeds come out with the rice-plants, the land is often rolled once or twice or even thrice should it be necessary.

Drag harrowing.] The tines of the harrows seldom reach beyond the depth of 6" to 8". Harrowing is done once, twice, or even thrice according to the character of the grass and weeds. One man and a couple of bullocks will harrow 4 bighas from 9 A. M. to 3 P. M. or two to two a half bighas if twice over. It is generally done in *Jaishta* (June.)

Hoeing.] It is done by the hand from time to time. The work done varies from one-tenth to half a bigha according to the thickness of the weeds.

The other work, besides harvesting, consists in drawing off the flush-water in lowlying lands and in bird-scaring—items of labour which the peasant never takes into consideration. He says he always remains in the field and does not mind bawling out from time to time to keep the birds away from his own fields or those of his neighbour, or drawing off the surplus water from them.

Harvesting.] The crop is always cut by the sickle. If during the operation the weather is bad and there is a lot of water in the field, it is cut at half the height of the plants ; if during dry weather much lower down. During wet weather, the plants are gathered and carted straight home and there either spread out, dried and then thrashed, or threshed at once and the straw is spread and dried afterwards and thrashed a second time if necessary. In dry weather, however, the plants, after being cut, are laid in swathes, turned at intervals, and when throughly dry carted home. Often carts are difficult to get and the peasant and his friends have to carry them home in heaps on their head. It is not unusual that tieing and stacking are done in the field. The dry plants are sometimes stacked before thrashing but this is only possible when the farmer is very well to do and is not pressed for money to pay his rent or does not suffer from a chronic state of starvation. With the great majority however the thrashing is done at once and it is the straw alone that is stacked, provided of course they are not obliged to sell off hand to pay their rent.

It is very interesting to watch the extreme good will that exists between the farmers during the harvesting season. They frequently join themselves into a harvesting body of men, who, without grudge or reluctance, expedite each other's work as much as possible with a view to make the most of a few sunny days that may be at their disposal. Frequently they form themselves into a gang of 20 men who make it a point to finish the whole work of harvesting on one's holding each day. No malice reigns in their breasts, no jealousy splits them into parties. They feel like brethren and work as such.

Cutting, treading and carting (or taking home on their heads) require generally four men per bigha. One and a-half to two men are required to thrash the yield per one bigha of rice. The crop ripens in three months from the time of sowing.

Diseases, injurious influences etc.] These are not much complained of in the case of the *Aus* crop. Birds, grasshoppers, and various insects destroy the crop partially but not much. A little white winged insect about ⅛ inch long is, according to some farmers, the chief enemy of the *ears* of rice. The eastwind in a dry *Ashar* (August) favors the development of the ears. An east-wind if high, dashes the ears of one plant against another and thus causes the grain to split.

Yield.] The yield per bigha varies from 5 to 10 *arees* equal to 2 maunds of *karni* weight *i. e.*, sixteen 5-seer *doans*. A *doan* is a measure containing the weight of 5 seers of *Kalai* which is equivalent to 3¾ seers of rice.

The yield of straw is about two *kahans* from a crop which gives the yield of grain as 10 *arees*. In bad seasons or if unduly freed the yield of straw is greater being about 2½ *kahans* per bigha, while that of the grain is less. The average yield per bigha in a good year, may be taken at about 2 to 2½ maunds of grain and about 12 maunds of straw.

Cost.] The total cost of cultivation varies greatly in different parts. With even two neighbouring farmers, the diversity is great. This difference primarily hinges on the efficiency or inefficiency of the ploughs and cattle. A man with a good pair of bullocks and a good plough will work his land much more cheaply than one who has a pair of sickly emaciated bullocks and a wretched plough. The highest and the lowest costs of cultivation are subjoined

1. The lowest cost under efficient management.

	Rs	As.	P.
6 Ploughing	2	0	0
Rolling and harrowing	0	8	0
Manure	0	8	0
Seed	0	8	0
Hand hoeing	1	0	0
Harvesting (including thrashing)	1	0	0
Stacking and winnowing of grain ...	1	0	0
Total	Rs 6	8	0

In this case the peasant says that the sale of of straw alone in a good year pays the whole cost of cultivation.

2. The highest cost under inefficient management.

	Rs	As.	P.
6 Ploughings	6	0	0
3. Harrowings	3	0	0
Hoeing	2	0	0
Manure	1	0	0
Seed	0	8	0
Harvesting, stacking, thrashing etc. ...	2	0	0
Total	Rs 14	8	0

It will be observed that in neither case does the peasant include the wear and tear of implements (which alone is about a rupee), rent, interest on capital etc., nor does he allow any importance whatever to his own labor or that of his oxen. Taking all these into consideration we leave it to the readers to make out what profit the peasant makes out of his farming. The peasant is under the impression that he makes in a bad year about Rs. 5 per bigha and in the best year about Rs. 10, while the more inteligent *mandal* will tell you that he loses by his rice, but makes up the loss by other crops.

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A NOTE ON

PAPER-MAKING

AT NASRIGANJ, BEHAR.

The manufactures turned out by machines are invariably cheaper than those turned out by hand, though we can not say that the quality of the former is also better. In India, for instance, poor people with limited means use cheaper machine-made cloth, though they always prefer native hand-made one, provided they can afford to pay higher price for the latter. This preference is no doubt due to better wear and tear of the hand-made cloth. The samething may be said of machine and hand-made paper. That the native industry in hand-made paper, though on its decline, is still holding its ground is well known to be due to its better wear and tear and, it is also said, to its comparative freedom from moth and insect attack. Although expensive, merchants, traders, and zemindars of India almost invariably use hand-made native paper for keeping records etc., certainly for no other reason than the one mentioned above. It therefore concerns us greatly to widely spread the knowledge of the art which is now confined to the working class in India, to foster it by all means in our power and not allow it to vanish as many others have vanished. We therefore gladly make room for the following note on paper-making as practised at Nasriganj.

Material.] The material used here for paper-making is old gunnybags. These bags are bought in large towns especially Lucknow, Benares etc, places where the papers manufactured here is mostly consumed. The price paid for the gunnybags varies from Rs. 1 to 1½ per maund.

The bags are cut by a tangi into peices about 2 inches square on a piece of wood. These pieces are then placed in a brick built tank and well soaked with water. Next day, the stuff is ground by a large *Dhenki,** two men working the *Dhenki* and one man stirring the stuff within the mortar of the *Dhenki* which is made of very hard sandstone brought from the Sasseram hills. When the parts are separated, the stuff is taken to the river in baskets and well washed. It is then spread and well shaken on a raised brick built and plastered platform called the *chaubutra.*

It is a second time taken to the tank over which is spread a sheet of cloth and over the cloth is poured a dilute solution of caustic soda. The caustic is prepared thus : in an earthen vessel are put together half a maund of lime and 10 seers of *shajimati* and 6 *gharas*† of water. The whole is well stirred and allowed to settle.

The caustic ley is well mixed with the stuff by hands and then for about a fortnight ground by the *Dhenki.* The ground mass is then again taken to the river in baskets and well washed.

It is next brought to the *chaubutra*, dried and taken to the tank to be again soaked in caustic and again taken to the platform and dried. It is then rolled in a *khatia*‡ made of grass ropes. Then it is again taken to the tank, soaked in caustic ley and ground by the *Dhenki* for another 20 days and then taken to the river to wash.

This process is repeated 8 times after which the pulped mass is kept in baskets. One basketful is then put in a tank smaller than the one mentioned above and in water-poured over it to fill the tank to the brim. It is then stirred by two men with sticks for a long time. Next day papers are made of this stuff till 12 P. M. when one *guddee* or 240 sheets are finished. A cloth is put in the *guddee* and over it planks. Heavy

* A lever arrangement with pestle and mortar.

† A ghara holds about 4 gallons of water.

‡ A kind of bed-stead.

weights are then put over the whole to press out as much water as possible. The sheets are then stuck on walls and dried.

The next step is to cover the unsized paper thus made with a thin layer of wheat paste. This is done by women. The papers are then hung on ropes to dry, after which they are spread on a plank and by means of a knife and cross-piece the margins are cut. The next step is to smooth the paper by a stone. Finally, the the papers are packed for sale. Each packet contains 240 sheets and is called a *guddee*. The price of 1 *guddee* is about Rs. 7.

Five different kinds of paper are here made and are known as

Hiranandi	These differ in size and thickness.
Dinapuri	
Chota Namuna ...	
Bara Namuna ...	
Suddin	

There are about 22 paper factories at present and the papers made here are mostly consumed in Lucknow and Benares. These papers are all, sold at the markets of Mirzapur and Gazipur. The trade has considerably declined after the establishment of paper-mills at Lucknow and Baly

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THE BELLARY MEMORIALS.

THE Madras Presidency was much exercised a few months back by a District grievance of an exceptional character, which can not fail to elicit wide spread sympathy, and, imperatively calls for remedial action on the part of the supreme Government. The curcumstances which demand such measures may be briefly summarised in two words—"chronic distress." The relief sought by the people concerned is for an irrigation project which would not only protect the District from the incursions of famine and its concomitant evils but would improve the condition of the ryot while benefiting the State. The panacea is the Toongabhadra Irrigation Scheme, to secure the carrying out of which, memorials have been presented to the Local Government and to Parliament. Before discussing the merits of this undertaking or commenting on the adverse views of the Madras Executive in connection with the same, a brief description of the country and some facts connected with it may be necessary for the better understanding of the subject We learn from a tract published by a Civil Engineer who served in the locality that the aspect of the greater part of the country is flat and open, coming under the class " dry " and the monotony of this almost treeless surface is only broken by numerous huge bare granitic elevations or protruding beds of gneiss forming the distinguishing feature in an apparently boundless plain. Much of the open ground is covered by rich black cotton soil, which is generally found overlying a calcareous deposit or a sort of Kunker. In discussing the absence of *drinking* water in several parts of the District, our authority draws a harrowing picture of this want in one particular place where the villagers have often during the year to travel a distance of five miles for their drinking water. In the face of such facts, we might well believe that the great distress, misery and loss of life adverted to by the petitioners in their Memorials have not been exaggerated. This sad state of affairs is confirmed by the periodical recurrence of famines once in every ten years or there about, which necessitate very heavy expenditure on the part of Government for relief works. It is said that in the famine of 1874-75, the outlay incurred was something like a crore of rupees The best proof, however, of the precarious character of the resources of the District is that derived from its Revenue Administration. From a statement obtained from official sources, we learn that the average remission of revenue on a period of 25 years (1846-1870) amounted to 4,21,000 rupees or about 4¼ lakhs per annum. All these facts and figures go to show the urgent need for something being done to mitigate the condition of the people, improve the country, and save public money. The recent tide of scarcity which threatened to overwhelm the Bellary and adjacent Districts, which necessitated relief works once again, points most forcibly to the necessity for speedy action. Hence the Memorialists urged that this period of scarcity, now happily passed, was opportune for initiating the Toongabhadra canal project, which had been frequently brought to the notice of the Government as the only means for averting the misery and loss to which we have here so often referred. The Tungabhadra river is the only source of supply which can be depended on for irrigation in the Bellary District. The means of securing this desideratum have, therefore not only attracted attention but have been thoroughly investigated.

The outcome is that the remedy is feasible but barred by cost. The desired end could be secured by an outlay of 1¼ million sterling, which the Chief Engineer, with no personal knowledge of irrigation and loss of the district, considers unremunerative and inadvisable. Although this authority was compelled to acknowledge that as "a means of affording a good water-supply to the town and cantonments of Bellary, it would be of value far beyond any amount that could be raised by rates, and supposing it could save the cholum crop on even 50,000 acres (the Kurnool canal watered 91,000 acres in the last famine), it would confer a benefit on the country to which it is impossible to assign a money value."

The arguments generally adduced by the Chief Engineer against the scheme are weak and untenable. They were ably met and refuted by the Memorialists, who correctly asserted that the saving in revenue from remission alone, not to mention the saving in famine expenditure once every ten years or so, and the great saving in life both of men and cattle,—would in a great measure recoup the interest on an outlay of a crore of rupees. This is a stern fact before which all opposition succumbs. Under these circumstances we trust that no time will be lost in devising and carrying out a scheme so vitally affecting the interests of the State and people.

NEWS

There were 86 cases of cattle poisoning in Madras last year, in 65 of which the poison was detected, but the Surgeon-Major has been called upon for a report as to whether medical officers should be asked to perform *post mortem* examinations on cattle in future.

The rainfall at Cherrapunji from the 1st of January this year up to the 27th of August has been 280·11 inches, as compared with 222·45 inches during the same period of last year.

The report of the Chemical Examiner of Madras for last year shows that there was a decrease in the number of cases of human poisoning sent to him for investigation, but an increase in the cases of cattle poisoning.

The opium revenue from five sales of Bengal opium, and five months' pass duty on opium exported from Bombay, amounted to Rs. 3,60,73,065, which is Rs. 21,10,565 better than the estimate. The whole of this has been derived from Bombay opium, as the receipts from Bengal are Rs. 4,60365 below the estimate.

Sir Massey Lopes, late President of the Royal Agricultural Society, London has offered a prize of fifty guineas for the best silo in operation during the ensuing autumn and winter. The attention now given in England to this system of preserving green fodder has led to the discussion of other projects for making ensilage, and the Royal Agricultural Society has taken steps to test them by offering a prize of twenty-five guineas for the best stack or other substitute for a silo.

The quantity of tea exported from China and Japan to Great Britain from the commencement of the season to the 27th of August was 98,485,898 lbs. as compared with 84,968,473 lbs., exported during the corresponding period of last year. The exports to the United States and Canada during the same period were 31,125,658 lbs., as compared with 34,030,922 lbs.

It has been finally decided that the Bombay Fine Arts Exhibition of February 1886 shall be held at the College Hall, and not at the School of Arts premises as at first intended. The Exhibition itself bids fair to be a success; the Secretary, Captain Simpson's appeals for donations having been already liberally responded to. The following sums have been offered as prizes :—(1) By his Excellency the Governor—Rs. 200 for best painting by amateur artists (2) by Her Excellency Mrs. Grant Duff—Rs. 50 for best specimen of jewellery of purely native art; (3) by the Jaghirdar of Arnee—Rs. 100 for best painting in oil or water colours.

Some interesting particulars relating to the production of petroleum in the Caucasus have been made public. It seems that out of a total of four hundred wells at Baku, only one-half of which are worked, one million three hundred thousand tons of petroleum have been extracted. Nearly one hundred and fifty refineries are established in or near Baku; and the whole of the raw product is converted by them into marketable lamp-oil at the well's mouth. Four hundred thousand tons of oil were exported to the principal western countries of Europe within the year.

The net amount of Indian Sea and Land Customs revenue, exclusive of the salt revenue for the first five months of the current official year, has amounted to Rs. 45,20,000 as, compared with Rs. 37,37,000 during the corresponding period of last year.

For the eight months of the current year ending on the 31st of August, the exports of wheat from all India have been close upon 700,000 tons. This does not represent a half of the surplus of last year's outturn available for export. Should circumstances continue favourable, especially as regards exchange, still heavier shipments may be made before the end of the year. Freights, however, are rising, and in Bombay steamers, have been already chartered for April-May loading at 25s.

In the second quarter of the current year tigers and cheetahs in the Madras presidency killed 762 bullocks, 777 cows, 254 calves, 241 buffaloes, 140 sheep, 194 goats, 26 horses and ponies, 21 asses, 20 dogs, and 21 pigs.

The public subscriptions to the fund for pushing Ceylon tea at the London Exhibition amount to Rs. 5,000, so that, with the Rs. 5,000, granted by the Colonial Government, about ten thousand rupees will be available in all.

The Mysore Government is at last aware of the impending famine, and is making arrangements for relief measures in concert with the Resident. Sanction has been given for wells to be dug all over the province, but where water is to come from when rain is withheld passes understanding The last official report is anything but encouraging. The Mysore Government admit the seriousness of the season's prospects. Everywhere disaster seems to be promised.

In the Melborne tea-market there have been large sales of China sorts. The profit on Indian descriptions is reported to be unfavourable.

A limited liability under the title of The Royal Flour Mills Company Ld, is in process of formation for the purpose of establishing a flour mill business in Bombay. The capital is two and a-half lakhs of rupees (with power to increase) with 2,500 shares of Rs. 100 each. The Directors are Messrs. G. W. Balke, H. C. Walker, Shapurjee Byramjee Katrak, and G. W. Read *(ex-officio)*.

The wheat harvests in Hungary and Roumania are officially reported to promise a fair average yield. The accounts from Bohemia, on the other hand, are bad.

During the month of July 595,369 cwts. of wheat, valued at Rs. 24, 86, 531, were shipped from ports in Sind.

The Bombay Forest Commission are holding preliminary sittings for the purpose of preparing questions to be submitted to the persons who are to be called as witnesses later on.

The five lime quarries worked at present under the permit system in the Kasi Hills exported during last year 7, 22,152 maunds of stone, and yielded a revenue to Government of Rs. 7,056.

In Fiji tea cultivation is extending, the tea being of excellent quality. The sugar industry is depressed.

A report from North Borneo says that gold in paying quantities has been found in the bed of the Segama river. Samples had been sent to Hongkong which, on analysis, gave excellent results; and a company is to be formed to work the mines.

The Director of Revenue Settlement and Agriculture, Madras, has been directed to arrange for the supply of a set of ordinary agricultural implements of full size, and of models of larger ones such as water-lifts, etc., for permanent view in London after the close of the exhibition in such place as the Home authorities may advise. The object of the collection is to allow English manufacturers and others to acquaint themselves with the character of the implements employed by Indian agriculturists.

The returns of the the Indian Tea Association of the shipments of tea from Calcutta for the month of August last, show that the quantity exported to Great Britain was 8,686,087 lbs., as compared with 9,282,159 lbs., during the corresponding month of last year. Australia and New Zealand took 422,359 lbs., as against 40,091 lbs., but only 185 lbs. were shipped to America, as against 5,184 lbs. Including the exports to other places, the total shipments of the season from the last of May to the 31st of August were 19,103,753lbs., as against 16,890,630lbs. The quantity exported from Ceylon from the 1st of October to the 13th of August was 3,135,487 lbs., as against 1,847,890 lbs.

The *Asian* says that the number of Australian horses likely to be imported to India this season will probably be the largest ever known. Several shipments have already arrived thus early in the season, thanks chiefly to the communication by steamers now estabished. Shippers of horses assert that if the sea is anything like rough horses travel better in a sailing vessel than they do in a steamer and this can be easily understood, as the motion of a sailing vessel is very much more easy for the horses than the constant jarring as well as rolling of a steam vessel. The shortness of the voyage by the steamer must, however, be taken into consideration as an offset to the increased damage suffered by the horses, and probably in a few years the majority of the importation will come up by steamers.

The Russians are trying through the natives to grow cotton in the Merve oasis. Some American cotton seeds which have been cultivated there, have produced cotton quite equal, it is said, to the American fibre; and the people of Merve are taking up the new cultivation with considerable enthusiasm.

At the last sessional examination at the Royal Agricultural College, Cirencester, the following Indian gentlemen have earned distinction. Their names are:—Messrs. Mookerji, Banerji, and Khasheras, all Indian students.

The *Indian Mirror* mentions with approbation, the fact that some educated natives have taken to trades and manufactures. One Babu Hirachand Chatterjie, a Railway Engineer, has opened a brass foundry, and is manufacturing, by means of machinery, numerous kinds of the brass utensils generally used by Hindus. These articles are said to be prettier than those usually made, and, being turned out by machinery, are also cheaper. We echo the *Indian Mirror*, when it says, "The only royal road to fortune is through prudent enterprise."

Cotton manufacturers in St. Petersburgh are much interested at present in the successful application of electricity for the purpose of bleaching cotton and flax fibres as well as tissues. The material is steeped in water, which is then decomposed by electricity, the oxygen which is thus set free at once acting on the fibres. This process has been found to occupy very considerably less time than the ordinary one.

The receipts of the American Crop at the ports keep comparatively small, and American spinners have evidently been taking a large proportion of the supplies, as shipments to Europe are light. Of these, moreover, the Continent is taking a much larger proportion than last season, a feature which is not unlikely to have an important effect on Liverpool later on.

The total export of wheat from the Central Provinces to the port of Bombay, from the 1st of October 1884 to the 12th of December, amounted to 2,939,106 bags of two-and-a-half maunds each.

We are glad to observe that through the exertions of a well known citizen, Rai Buddri Dass Bahadur, Calcutta is in a fair way to have shortly *Pinjrapole* or a hospital for diseased and disabled animals, like the similar institution at Bombay.

A meeting was held at the Collector's office, under the Presidency of Mr. East, the Collector of Poona, to decide about the Cattle Show for the year 1885, but it was found that the funds would be quite inadequate to meet the requirements of the Show, as Government have only offered Rs. 500, the City municipality Rs. 500, and the suburban Municipality a small sum. Consequently it was resolved to raise funds from the general public, and it is found that the fund raised will answer the purpose, the Cattle Show will be held this year, otherwise there will be one next year. The Committee of the Cattle Show will meet on the 15th October next.

Government have assigned, free of rent, a piece of land of 2 acres in extent for the formation of a model farm at Narsapur, Madras, on the conditions that the farm be subject to inspection from time to time by the Collector and Agricultural Reporter to Government, and that, in event of the experiment being found to be a failure, or the object for which the grant was made be parted from, the land be taken back by Government without allowance for any improvements.

The Ceylon Govenment has decided on establishing public fish-curing yards on the model of those which have proved so successful in the Madras Presidency. It might be worth while enquiring whether the same system could not advantageously be introduced into Bengal. The development of the Madras fisheries since it came into operation has been almost equivalent to the creation of a new industry; and if equally good result could not be obtained on the coasts and rivers of Bengal it would not be from lack of fish.

In connection with the attempt to ascertain the commercial value of the products of babul tree, Government have directed further and more systematic experiments than hitherto to be carried out to ascertain the average outturn of bark and pods, and steps to be taken to ascertain the areas of babul trees sufficiently near to one another to render it likely that they can be worked with advantage. From experiments hitherto made it has been roughly estimated that the average outturn per tree of pods, with the seeds removed, would be about 50 lbs., and that of dry bark about 125 lbs.

A deposit of sulphur was lately accidentally discovered in the Narsapur taluk in Godavari. In digging on a piece of waste land, some earth was turned up, the peculiar appearance of which attracted the attention of one of the passers-by, the village magistrate, who, having secured a small quantity of it, forwarded it to the Civil Surgeon. A rough analysis of the earth disclosed that it was strongly impregnated with sulphur, and a further examination of the locality in which it was found resulted in the discovery that the deposit extended over a considerable area.

The Weekly Season Reports published by the *Mysore Gazette*, are invariably melancholy reading. Every week, in every district, foot-and-mouth disease in cattle, is declared to be more or less prevalent. This wretched announcement is so constant, that very few people take the slightest notice of it.

The British Forestry Commission have not had time to complete their inquiry, and recommend the appointment of another Commission. The evidence taken so far demonstrates the urgent necessity of establishing a school of Forestry for England and the Colonies.

The Ceylon tea exports for the season reach the respectable figure of 3,302,325 lbs., with another month to run. Tea-making is still going on actively, on some plantations.

A Colombo telegram dated 15th September to the Bombay Gazette, says that the Shanghai customs show a large increase of the trade in Indian cotton yarns. The failure of the cotton crops in China will create an increased demand for Indian goods.

We learn, from a list of the awards to exhibitors at the Antwerp Exhibition, that the following awards have been made to Mr. Framjee Pestonjee Bhumgara, of Madras, Bangalore and Bombay—Class 6—General application of the art of drawing and modelling—silver Medal. Class 12—cheap and fancy furniture &c.—Silver Medal. Class 19—goldsmith's and silversmith's work—Silver Medal. Class 29 silk and silk fabrics—Bronze medal class 34—jewellery and precious stone—Bronze medal. Class 37 toys—Honorable mention.

It is stated that in anticipation of a famine, Hyderabad grain-merchants have been importing food grains to an immense extent.

The Bombay Chamber of Commerce has commenced to issue telegraphic weather and crop reports from the cotton districts.

Owing to the lateness of the season, indigo manufacture will not close in Behar until about the beginning of October. The results will probably be less favourable than were anticipated, as the produce from the second cuttings has been bad. The nearest approach to an estimate of the crop yet made put it down as between 52,000 and 53,000 maunds, of which about 12,000 are *khoonties*. The reports from Benaras and the North-West provinces are growing worse. Very serious damage has been done to the crop by the late heavy rain, and though the weather has now improved, it is too late to be of much use. It is expected that the yield of these districts will fall very far short of that of last year.

Last year, of the ten Jute Mills in the Burdwan division, all but one showed a falling off in the value of their outturn, and one mill was closed early in the year. Business in shellac was larger than in the previous year, but was also unremunerative, as the price of the raw material increased, whilst that of the manufactured article decreased.

The Government iron works near Barakur appear to have done a large trade in the year 1884-85, as the sales of iron rose from 122,000 to 498,000 tons. Both coal and iron ore are plentiful near the works and a good supply of limestone has now been secured by paying a royalty to the owner of the land.

On the other hand, the coal trade fell off considerably, the exports from Raniganj being only 635,921 tons, as compared with 796,937 tons in the previous year. Messrs. Burn and Company's pottery works at Raniganj continue to flourish, and they give employment to 700 men a day, whilst the value of the last year's outturn is estimated at Rs. 2,15,000.

Owing to the competition of Chinese and Italian silk, the manufacture of mulberry silk in the Burdwan division continues to decline, but on the other hand the demand for tussur silk is steadily increasing. The outturn of this silk in the Birbhum district last year was valued at Rs. 96,030, as against Rs. 46,675 in the previous year. The higher classes of Indians are said to prefer the country-made cloth, owing to its being more durable than that of Manchester, but the poorer classes, with their usual improvidence nearly all buy the latter, owing to its being somewhat cheaper. The consequence has been that many hereditary weavers have abandoned their calling and taken to other work. Still some qualities of country cloth hold their own in market, and it is estimated that at the Howrah hat, the chief mart for the cotton goods of Hughli, Howrah, Midnapur and parts of Nuddea, the sales of this cloth amount to 18 lakhs of rupes a year.

The Americans assert that the flour made from sweet potatoes is sure to come largely into use, as it is most economical, requiring hardly any sugar to be mixed with it.

The value of the Gold imports during the first four months of the current financial year was Rs. 1,37,47,713 and of the exported Rs. 10,14 505; whilst the value of silver imported was Rs 4,85,14,487 and of that exported Rs. 20,32,910. This leaves a balance of both metals in favour of imports of Rs. 5,921,4785.

The salt market during the first quarter of the year 1885-86 showed considerable dulness as compared with the corresponding quarter of the last year. The quantity of salt of all descriptions cleared this year was 21,29,421 maunds against 24,78,824 maunds, and the net amount of duty levied was Rs. 41,03,558 against Rs. 47,90,905.

Owing to the improvement of trade in Bombay, the Millowners' Association has decided not to close the mills more than four days in the month inclusive of native festivals.

The British Board of Trade returns for July show no sign of improvement. Both imports and exports are less than in July of last year, the former by £2,356,000, and the latter by £1,866,000. The falling off is distributed over a great many heads, and in most cases reaches only a small percentage but is remarkable in the case of refined sugar

of which the export is 48 per cent, less than in July 1884.

The rice trade of Bassein is expanding considerably. The exports for the current year already reach 170 000 tons, and are expected to reach 200,000 as paddy is still coming in large quantities. The season has been the best ever known there.

The annual show of the Highland and Agricultural Society was held at Aberdeen on July 28 in fine weather. The entries of live stock we are 1,294, as compared with 2,515 at the show held in Edinburgh last year. Among the successful competitors were the Duke of Richmond and Gordon and the Earls of Breadalbane, Airlie, and Aberdeen. Mr. George Wilken. Waterside., Aford, carried off the chief prizes in the polled classes. Mr. F. E. Ilgy, Westmoreland, got the Tweeddale gold medal for the best short-horn bull in the yard.

The probability of the Nizam postponing his contemplating journey to Europe, in view of the threatened famine in his territory, is still discussed. A Hyderabad paper says that the month of August has passed with little or no rain, and there are only "the return monsoons" of October to look forward to. The prospects of great scarcity, if not actual famine, are therefore forcing themselves very strongly upon the authorities. In the meantime Mr Rocke, the London Agent to the Government, is detained in Hyderabad pending final instructions from his Highness. It is reported that Mr. Rocke submitted an estimate of twenty lakhs of Government rupees as the probable cost of his share of the expense, but the local contemporary thinks the cost would not be very far off fifty lakhs, or half-a crore of rupees.

Poona Arts Exhibition was opened on the 25th of September by Lord Reay, in the presence of large and distinguished assembly. The exhibition is pronounced a great success. —

CORRESPONDENCE,

A PLANT RICH IN TANNIN.

In the August number of the "Indian Agricultural Gazette there is an article recommending the cultivation in India of the Australian Wattle, as it is said to yield " the best material in the world " for the purpose of the tanner." There is on this side of India a plant which, in the estimation of the Indian tanner here, is superior in tanning properties to all plants used in India for the purpose. In districts where Marathi is the Vernacular, the native name for the plant is Tarwad. In districts where Canareese is spoken it is called Honawrigida or simply Awrigida. Its botanical name is Cassia Auriculata.

Leather cured by the bark of this plant turns out softer, is preserved better and lasts longer than that cured by any other material, at any rate this has been the invariable reply to oft repeated enquiries I have made on this point.

In the Bombay Presidency, the habitat of the plant is chiefly the open treeless districts. It grows there wild in every variety of soil, from the richest to the poorest, and in any situation, hill, dale or plain. It is a hardy shrub of quick growth, and if cultivated to the extent of simply giving up space to it, probably neither European planter nor Indian ryot need wait for the introduction into India of the Australian Wattles for a good investment in a tannin producing plant.

Whether the cultivation of this plant would be a paying investment or not might be tried by the government, through the Forest Department.

The cheapest way to do this would be to set apart a few acres in waste ground, in the open country for the growth of this shrub alone, all other shrubs in these areas being destroyed. Self-sowing would do the rest in multiplying the plants. After three years the shrubs would probably be in sufficient numbers and of growth sufficiently large to yield enough bark to place in the local markets for an experimental sale. The plants would not be killed in the cutting of the twigs for barking, such pruning would probably have the effect of increasing the number of shoots in each plant for the next season's crop.

W. S. Price,
Asst. Settlement. Officer,
Revenue Survey,
S. M. Country, Dharwar.

EXTRACT

The Cultivation of Ground-nut,

BY

MR. KRISNAMACHARIAR OF ANANTAPUR.

[*Manufacture of the oil.*]

The nuts are thoroughly dried and beaten with sticks, the seeds are separated from the husk by winnowing

The services of 2 men and 1 woman are required for 6 hours to husk a cartload. The outturn of kernels is nearly 4 colums or about 360 lbs. The wages paid to them is nearly annas 10.

The kernels are pressed in a mill for the sake of of the oil they contain.

The native oil mill consists of a wooden or granite mortar with a pestle. Generally 2 oxen are yoked to a projecting spar or gaering. About 30 to 40 Madras measures of seed are thrown in to the mortar and abouta measure of water is added in the beginning. As the mill goes on grinding, a man is engaged in throwing in the seed which may have got displaced. In about 4 to 5 hours the oil fills the mortar while the fibrous cake lines it. ...

The grinding is then stopped ; the pestle removed and the oil is taken out as strained while the cake is scraped out and dried.

One hundred measures or about 300. lbs. of kernels yield about 25 to 30 measures of oil and 35 to 40 visses or 110 to 125 lbs. of cake ; more oil may be obtained when the seed is pressed in an improved oil mill. By heat and pressure the quantity may be increased to nearly half the weight of the nuts.

It is a curious fact and illustrative of the imperfect manner in which the oil is separated from the seeds that in France the cake obtained from this country is once more subjected to pressure and from 10 to 12 per cent. of oil is easily procured.

When the oil cake is meant for feeding the stock such loss is of little consequence. But when the cake is directly applied as manure it is a serious loss, inasmuch as the oil cotained in the cake is of little or no use in adding plant food to the soil.

It is a fixed edible straw-colored oil, esteemed for domestic purposes as it does not become rancid so quickly as other oils. Its specific gravity is 0·916. In brilliancy it is far superior. In an experiment made in France as to the relative combustion of ground-nut oil and olive oil in a lamp having a wick of one-eighth of an inch in diameter, it was found that an ounce of ground-nut oil burned 9 hours and 25 minutes while olive oil under similar circumstances burned only 8 hours. It has an additional advantage of giving no smoke. In this country it is used for adulterating gingelly oil and in Europe the clarified oil is passed off for olive oil.

The value of the cake as a feeding stuff has been clearly shown both by experiments and scientific reasoning.

It is often complained by cattle owners that its use is often attended with hard-breathing in their cattle. No doubt there is some truth in what they say ; but if a dessert spoonful of salt be given with the cake the evil effects will be prevented. Experiment has proved that draught cattle will keep in better condition when solely fed on this cake than when fed exclusively on horse gram. As a food for horses this cake may safely be recommended. In the beginning the plan to be adopted is to deduct one-half the usual allowanee of gram and substitute for it an equal weight of cake. In this way a saving of 25 per cent. could be effected in the cost of food of every horse now fed on gram, while the condition of the animal also would be improved. The analysis of this valuable article will be useful.

	Per cent.
Moisture	11
Oil	10
Allumunods	30
Sugar starch, &c.	36
* Ash	3-5

The high percentage of introgenous matters explains why the cake is so valuable. It may be observed here that the high percentage of nitrogenous compounds in the cake causes a great increase in the value of manure by animals fed on it ; for it is proved by the best authority on the subject Mr. J. B. Lawes of Rothamsted that the loss of nitrogen in the consmuption of cake is about one-tenth of that which it contains, the rest passing off in the manure. ...

Enormous quantities of ground-nut kernels are exported yearly from this Presidency. As an instance I may here state that the quantity of of seeds booked at one small Railyway Station, Nagari in the Karvetnagur Zemindari, during the year 1884, was about 90,000 maunds of 82 lbs. each or 3,306 tons. It represents a serious loss of rich manurial matter to the motherland from which the nuts were obtained.

Note on the Nitrogenous Matters in Grass and Ensilage from Grass.

By EDWARD KINCH,

Royal Agricultural College, Cirencester.

That grass and other fodder crops, like most crude vegetable products, contain nitrogenous matters other than albuminoids, is well known, also that the amount of these matters depends largely on the relative stage of development of the plant, the less mature plants containing a larger percentage of non-albuminoid nitrogen ; but it is still common, in expressing the results of analyses, to represent the whole of the nitrogen as existing in the form of albuminoids. Our knowledge of the nature of these nitrogenous matter is yet

*Contains phosphates and phosphoric acid.

very imperfect. Ammonia and nitric acid have been detected in some cases, and possibly in some cases alkaloids and peptones, but the principal part of the non-albuminoid nitrogen of grass appears to exist in the form of amides and amido-acids.

O. Kellner (*Bied. Centr.*, 1879, 270 ; *Chem. Centr.*, 1879, 10, 744 and 761 ; *C. J.*, 1879, Abstr., 819) has determined the amount of non-albuminoid nitrogen in many specimens of grass and other fodder plants at different stages of growth, the soluble albuminoids being in most cases precipitated by lead acetate. Of the total nitrogen in the crops from 7·5 to 38·5 per cent, was found to be non-albuminoid, the higher amounts being, especially in the case of the grasses, in the younger plants.

Peter Collier, in report to the Commissioner of Agriculture for 1880 (*Rept. Commis. Agriculture* 1880, Washington), gives the result of the examination of 15 grasses and three leguminous plants, each at from three to six different stages of growth, and of 37 separate specimens of grasses mostly in full flower. * * *

In the great majority of cases the non-albuminoid nitrogen constituted between 6 and 40 per cent. of the total ; in a few cases it was lower ; in one case none was present, and in two cases it rose to 50 per cent. of the total nitrogen.

H. P. Armsby (*Rept. Connecticut Expt. Stat.*, 1879) determined the non-albuminoid nitrogen in 21 samples of fodder, by various processes ; its amount was from 8·9 to 39·6 per cent. of the total nitrogen.

The results of other experimenters are in accordance with these. In the examination of several specimense of the principal plants of the hill pastures of Scotland, including not only grasses, but *Cyperaceæ*, *Juncaceæ*, &c., I have found that usually from 10 to 33 per cent. of the nitrogen is non-albuminoid.

What may be the exact nutritive value of these non-albuminoid nitrogenous bodies is as yet unknown, but it is certain that the amido-compounds can replace albuminoids in food to a limited extent only.

Certain amides, as asparagin, can to a certain extent prevent waste of albuminoids by preventing their oxidation ; but cannot entirely supersede them. See Weiske and others (*Zeitichr. f. Biologie*, 15·261, and 17·415).

Whether, during the fermentations to which grass and other fodder crops are subjected in order to produce ensilage, the albuminoids which they contain undergo any change into other nitrogenous bodies not having the physiological functions of albuminoids, and to what extent such changes occur, is a matter not only of much scientific interest but of great practical importance in considering the economic relations of ensilage. This point has been hitherto unnoticed in published analyses of ensilage, although it seems very likely such changes would occur during the processes, in some respects allied to digestion, to which the fodder is subjected. As a small preliminary contribution, I record analyses of a sample of grass and of the ensilage made therefrom.

	In dry matter. Ensilage.	In dry matter. Grass.
Water lost at 100° C ...	—	—
Ethar extract	5·55	7·12
Total N × 6·25	9·32	9·44
Fibre	28·82	31·89
Ash	8·50	10·10
Soluble carbohydrates, etc., by difference	47·81	41·45
	100·00	100·00
Albuminoids by phenol method	8·46	4·25
Albuminoids by copper hydrate method	8·57	4·46
Albuminoids by mercuric hydrate	—	4·55
Albuminoids by lead hydrate	—	4·72
Per cent. of total nitrogen which is non albuminoid, by phenol method ...	2·2	54·9

The amount of free acid is not given above; it varied very much with exposure ; after exposure for a short time the total amount was found to be equivalent to 0·87 per cent. of acetic acid. The fresh ensilage distilled with water gave only 0·03 per cent. of volatile acid, as acetic acid.

The method referred to as the phenol method is Church's processes, consisting in the estimation of nitrogen, after precipitating all the albuminoids, with a little metaphosphoric acid and a hot 4 per cent. solution of carbolic acid. In the copper hydrate method, a modification of Ritthausen's, the soluble albuminoids were precipitated by heating to boiling with recently prepared copper hydrate. In the ensilage the soluble albuminoids were also precipitated with mercuric chloride and a very slight excess of potassium hydroxide, aided by heat. These two methods may be supposed to precipitate any bodies of the nature of peptones, if such were present ; they gave slightly higher results than the other methods. The result with the copper hydrate method, with grasses, I have invariably found to be slightly higher than those by the phenol method,

possibly owing to the presence of some acid containing nitrogen and forming an insoluble compound with copper hydrate. All care was taken in collecting and sampling the specimens, and if we assume that they were strictly comparable, though it is difficult to get such specimens with such material, then judging from the amount of ash, there has been a loss of about 18 per cent. of combustible constituents, with a slight loss of water. The percentage of ether extract has increased, as has always been noticed before in ensilage, sometimes in part owing to the formation of lactic acid. The amount of soluble carbohydrates has decreased through fermentation, and has not been reinforced to the full extent by alteration in the fibre, which consequently has slightly increased in percentage. Such changes are exactly in accord with analyses of clover-hay and ensilage by Dr. A. Voelcker, quoted in the *Field* of January 20, 1883, and of sainfoin and its ensilage by Weiske and of others.

But the most striking change is in the condition of the nitrogenous matters; in the grass only 9 per cent. of the nitrogen is non-albuminoid, and in the ensilage nearly 55 per cent. reckoned from the albuminoids by the phenol method. The increase in the percentage of total nitrogen in the ensilage was about one-half only of the increase in percentage of ash, indicating that a loss of nitrogen may have taken place.

The only published analyses bearing on this point are some in which the soluble nitrogenous matter, considered, however, simply as albuminoids, and the insoluble nitrogenous matter were determined separately. Voelcker, quoted in the *Times*, March 21, 1883, found 57 per cent. of the nitrogenous matter of rye ensilage soluble in water, and 40 per cent. of the nitrogen of maize ensilage.

Sutton (*Field*, February 10, 1883, *Chem News*, 47.,287) gives two analyses of hay and two of ensilage made from the same two grasses. In these cases the fermentation had apparently not proceeded to the same length, or, perhaps, in the same direction, as in the ensilage above mentioned, for the percentage of ash was not higher in the ensilage, and the soluble carbohydrates had increased, whilst the indigestible fibre had decreased; but here again the soluble nitrogenous matter had increased from 12 per cent in the hay to 53 and nearly 60 per cent. in the ensilage. Doubtless the whole of the soluble nitrogenous matter in these cases was not albuminoid.

Whether such changes in the nitrogenous matter always take place in ensilage, or, as is likely to a less extent when the fodder is subjected to a greater pressure, and what exact forms of nitrogenous bodies are produced (only traces of ammonia were found in this case), and whether and to what extent the albuminoids are lost as food are points requiring investigation; I hope ere long to be able to throw light on some of them.—*Journal of the Chemical Society for 1884. Paper XVIII.*

Note on the Chemical Alterations of Green Fodder during its Conversion into Ensilage.

By Dr. O. KELLNER,

Imperial College of Agriculture, Tokio.

In a short preliminary contribution to the chemistry of ensilage, Professor Edward Kinch recently recorded the results of a few analyses of grass and of the ensilage made therefrom, introducing the account of his experiments in the following words:—"Whether, during the fermentations to which grass and other fodder crops are subjected in order to produce ensilage, the albuminoids which they contain undergo any change into other nitrogenous bodies not having the physiological functions of albuminoids, and to what extent such changes occur, is a matter not only of much scientific interest, but of great practical importance in considering the economic relations of ensilage. This point has been hitherto unnoticed in published analyses of ensilage, although it seems very likely such changes would occur during the processes, in some respects allied to digestion, to which the fodder is subjected"

Mr. Warington, commenting on these researches, said: "As far as he knew, Professor Kinch had been the first to determine the relative quantities of albuminoid and non-albuminoid nitrogen in ensilage. There had been many analyses of grass and ensilage published, but no one yet had really made a quantitative experiment, i. e. weighed all the grass which went in and the ensilage produced" (*Chem. News*, February 15th, 1884, 78).

The subject in question really deserves great attention, as at the present time American and French farmers are so enthusiastic about the preparation of ensilage, practised since remote times in Germany. I may therefore be allowed to refer to some former experiments of mine made at Hohenheim, and published in detail (*Landw. Versuchs-Stat* 25, 1880, 447-463; *and Bied Centr.*, 1880, 724—729).

The investigation embraced "quantitative experiments" with the mangold leaves, which, immediately upon cutting, had been weighed and stamped in a silo. The total fresh weight of the leaves amounted to 25,000 kilos. In the midst of the silo, and completely surrounded by leaves of the same kind, but separated from the adjacent

mass, carefully taken sample of 250 kilos. was buried and treated in the same manner as the whole silo: the latter had been simply cut in the soil, which consisted of a sandy clay. Owing to the pressure exerted on the leaves by stamping them in, and by a large mound of earth over the silo, a considerable quantity of juice was sure to be pressed out and to flow into the soil. I therefore filled several jars with weighed samples of leaves, closed them with sheet India-rubber, and buried them also in the midst of the other leaves. The jars were thus exposed to the same conditions of temperature as the other parts of the silo, but they did not admit of any loss of their contents. The leaves were left in the pit from the 19th of October, 1879, till 16th of March 1880, when they were taken out and analysed. The following was found to be the percentage composition of the dry matter :—

		Ensilage.	
	Original leaves.	Out of the jars.	Out of the silo.
Crude protein ($N \times 6·25$)	26·71	28·56	21·23
Ether extract	2·75	7·94	8·79
Fibre...	13·84	11·55	18·31
Non-nitrogenous extract ...	38·28	34·77	39·67
Mineral matter (free from C and CO_2	18·42	22·18	12·00
(Triglycerides)	(2·59)	(3·20)	(5·02)
Total nitrogen	4·274	3·765	3·397
Albuminoid nitrogen ...	3·086	1·518	1·850
Nitrogen in peptones ...	none	0·295	0·092
Nitrogen in amides, etc. ...	1·058	1·952	1·455
Nitrogen in nitric acid ...	0·130	none	none

The following figures will show how much of each component of the dry original leaves was left in the ensilage after a complete and normal fermentation :—

		Ensilage.	
	Oriental leaves.	Out of the jars.	Out of the silo.
Dry matter	100·0	82·00	50·64
Total nitrogen	4·274	3·087	1·907
Albuminoids	19·29	7·78	5·82
Peptones	none	1·51	0·29
Non-albuminiod nitrogen...	1·058	1·601	0·737
Nitric acid	0·502	none	none
Fibre	13·84	8·47	9·27
Triglycerides	2·59	2·62	2·54
Mineral matters	18·42	18·19	6·06

Hence of 100 parts of each constituent, the following loss (−) or gain (+) had occurred during storage :—

	Jar ensilage (unpressed)	Silo ensilage (pressed)
Dry matter	−18·0	− 49·4
Total nitrogen ...	−27·8	− 59·8
Albuminoids . ... / Peptones ...	−51·8	− 68 3
Non-albuminoid nitrogen	+ 51·3	− 30·4
Nitric acid	−100·0	−100·0
Fibre	− 31·6	− 33·7
Triglycerides	+ 1·2	− 1·5
Mineral mattor ...	none	− 66·5

The amount of loss or alteration caused by the fermentation alone is seen from the first column. *More than half the albuminoids had been decomposed,* whilst there was no loss nor increase of true fat, and 31·6 parts out of 100 of the fibre had been dissolved or removed. That the fermentation in the sile had taken place in just the same manner as in the jars, is proved by the fact that the loss of fibre is the same in both cases. The fat had not undergone any diminution or increase, In consequence of the high pressure, much more of the soluble components had been lost from the leaves in the silo than from those in the jars.

The report above referred to, moreover, contains determinations of the *oxalic acid and complete ash analyses* of the fresh leaves and of the ensilage prepared from them.

It appeared to me peculiar that so *much nitrogen* (27·8 *per cent*) *had been lost* * during the fermentation in the jars and I therefore resumed this investigation in Japan with my assistant, Mr. J. Sawano, and we have found that the largest portion of *this loss is caused by the preparatory drying of the ensilage* before reducing it to a proper powder : ammoniacal organic compounds are volatilised when drying the sour fodder, probably by dissociation of some organic salts (ammonium lactate.) A report on this investigation will be published erelong in *Landw. Versuchs.-Stat.*, edited by Professor Nobbe.—*Journal of the Chemical Society for 1884. Paper XLVIII.*

A NOTE ON ECONOMIC REFORM,

(From the Poona Sarva Janik Sabha Journal.)

On a calm and comprehensive review of the economic situation in India, it is impossible to

* Prof. Kinch observed a loss of about 13 per cent. of the total nitrogen.

resist the conviction that, in spite of all the benevolent intentions and efforts of Government, in spite of railways and canals, and in spite, too, of growing trade and extending agriculture, the country is getting day by day poorer in material wealth, as well as weaker in productive capacity and energy. The fast-proceeding decay—we might almost say, the rapid collapse, of our varied manufacturing industry, which once sufficed to meet the requirements of a growing population, is at the root of this deplorable state of things. Its re-habilitation, therefore, would appear to be an imperative necessity, if the industrial future of the country is not to be dark and disastrous.

Looking at the question in its bearings upon the recent frequency of Famine, its causes and remedies, the Famine Commissioners also have come to the same conclusion. They think that the absence of "a variety of occupations" is the chief cause of the poverty and distress of the people, and they suggest in their Report that the State should undertake, as part of its economic policy and with a view to provide an effective remedy against famine, the establishment of manufactures in the country. Mr. Justice Cunningham of the Calcutta High Court, who was a member of the Commission, writes in reference to this suggestion, in his "British India and its Rulers" p. 236 :—"Although protection from foreign invasion, the maintenance of orders, and the diffusion of a feeling of security, are conditions precedent to all industrial progress, the accomplishment of these invaluable objects does not complete the task of the Government; the direct, deliberate, and systematic promotion of industrial enterprise is, though a later, not a least important duty, and its thorough recognition by the State would be the most important administrative reform of which the Indian system is at present susceptible."

Sometime ago the *Times* had the following :—

"The Indian Famine Commission having expressed its views as to the desirability of encouraging a diversity of occupations and the development of new branches of industry in India, the Government of Madras submitted certain proposals, which embraced the temporary appointment of a Government Reporter on arts and manufactures, and a Government mineralogist."—"Looking to the importance of the subject, the Secretary of State has accorded his sanction to the proposal."

The importance of this step taken by the Madras Government is clear. It shows that the responsible authorities, both in India and England, have awoke to the necessity of a radical change in their economic policy. The International Exhibition proposed to be held in Bombay in the cold weather of 1887, will forcibly draw the attention of our Local Government too, to the same necessity.

In the near future, therefore, we may expect vigorous efforts on the part of Government to promote what we so sadly want, a co-ordinate system of industries. A large development of manufacturing industry in the country will be the aim and the goal of such a policy.

Under these circumstances, our duty as a nation, would appear to be clearly this :—We should take our proper share in the field of new enterprize. We must not be content with a subordinate part, but should take care to be principals in the concern. Particularly, we must guard against the fatal tendency to allow ourselves to be made mere *passive* recipients of the boon. Capital and skill might be imported from abroad to any extent that may be found necessary. But we must not suffer the foreigner to monopolize and appropriate the whole field to the unjust and disastrous exclusion of the children of the soil. We may borrow money from him as much as we please, and pay him fair interest on it; we may employ his skell and technical training too on condition of paying fair remuneration. But any further claim on his part, to claim the whole or part of the ownership of the field, we are bound strenuously to resist. We cannot, in justice to ourselves or to posterity, hand over our concerns in proprietory right to the enterprising foreigner. The undertakings—of whatever nature, and on whatever scale they may be,—must be our own; profits accruing therefrom must be ours too. There is surely nothing in the reason of things to prevent us from getting a fair start in the race, and having in course of time thriving industries of our own. We might hope to be able, by force of unremitting and persistent effort and watchful care, to do good business and repay the loans obtained from foreign capitalists, and be absolute masters of our own house. Nor does it look like catching at the moon to hope that we might one day have, within the four corners of this country itself, the needful supply of skilled labor, technical knowledge and abundant capital.

The growth of a foreign aristocracy of wealth in the country is to be deprecated on more grounds than one. It is not only an economic evil of the first magnitude, but a source of grave political danger. A pre-occupation of the national field of profitable investment by foreign enterprise cannot fail to be highly detrimental to the interests of coming generations. Politically speaking, if we do not misread history, power must gravitate towards property and wealth, and a strong foreign mercantile interest in the country would not fail to be a very troublesome active factor in the State; it

would always be disposed, to use the power and influence it could command for its own selfish aims and dominate the action of Government in its own favour.

The growth of foreign enterprises in the country under Government auspices is, thus, in the immediate prospect, a serious danger to be carefully and jealously guarded against, and it is of supreme importance that we, the natives of the country, should claim and have our proper share in any industrial development that might be effected. There are, however, formidable difficulties in the way of our coming to the fore-front in the field, pushing aside or pushing back the competing foreigner.

(1) There is, in the *first* place, the inveterate and deep-rooted habit with us to look up to a superior for lead and guidance. Once the ice is broken and the start given, our people will move, but *not before*, of themselves and by themselves. The energy implied in a personal, independent, and self-reliant initative,—which is one of the most notable characteristics of European progress, is here wanting to a lamentable extent. Perhaps, as Professor Wordsworth thinks, originative talent has yet to be developed amongst us.

(2) *Secondly*, there is the striking absence of that spirit of co-operation and habit of corporate united action, by which alone large enterprises can be started, and success won. Our merchants and traders are literally a scattered body with no bond of union, each mindful only of his own business in the good old ways; our towns are simply so many *disjecta membra*, so many isolated units without co-herence, seldom acting together, and hardly with any common sympathies, and each concerning itself with its own wants and affairs almost exclusivly.

(3) *Thirdly*, there is dense ignorance among them regarding the very first principles of trade and economy. They scarcely know the resources of their own country, or the requirements of its several home markets, not to speak of those of other nations. How many, for instance, can tell us in what parts of India coal or iron is found in sufficient quantities to admit of manufactures being started, or where conditions exsit favourable for the establishment of the silk or woollen manufacture? Or again, how few know, what manufactured articles are in general demand in the markets of Bengal or Panjab? Nor do they possess any tolerable acquaintance with the cardinal truths of economical science. Hardly 1 in 100 can appreciate the significance of trade statistics, or variations in the value of the Rupee, or the rates of exchange. They do not even keep themselves informed of the quotations of prices in markets other than those with which they are in immediate contact or communication.

(4) *Fourthly*, all over the country, technical skill and training are fast dying away. As long as our caste system rested strongly on the professional basis and each caste and each family followed its own profession with almost religious devotion, mechanical skill was in a sense hereditary, and was handed down from father to son. This is no longer the case; time and circumstances have altered a good deal; professions do not follow caste or family descent; and there is irrecoverable loss of skill and training as the consequence. Besides, our products of manual skill and labour find but little sale in foreign markets, and but a limited one in our own, coming as they do into competition with cheaper and finer ones produced by Machine labor; our skilled mechanics and artists are fast losing their calling, and are taking to the plough (*Vide* Birdwood's Indian Arts) The result is, that our labor, though we have plenty of it and cheap, is for the most part becoming *unskilled* labour, and the necessity of importing skilled labour from abroad is getting stronger in proportion.

(5) *Fifthly*, there comes the greatest of difficulties, the want of capital. There are no large accumulations of hoarded capital in the country available for investment. This was strikingly illustrated in the evidence of Mr. Westlake who was examined as a witness before the railway Committee in London. He pointed out, by reference to the share lists of Indian trading companies, and to the history of Government loans raised in India, that all the capital that is invested in large enterprises in this country eventually comes from London; as also, Government borrowings ultimately revert to the London Market. The Cotton Mill industry of Bombay, which alone is in the main a *native* industry, employs not more than 5½ crores, part of which capital again is European; and the net earnings cannot exceed about 50 lakhs. We have evidently nowhere in India merchant-princes in the English sense of that word. We have no Barings, and no Rothschilds amongst us. The annual income per head of the population is hardly one twenty-fifth of what it is in England, or the United States

(6) *Sixthly*, the policy of protection has been unfortunately abandoned by our British rulers. A Parliamentary resolution passed in 1878 sounded its death knell, and the recent removal of the cotton duties put the final seal to its abandonment. Our industries, therefore, however infant and undeveloped, and unorganised, cannot hope to be any longer under the protecting shadow of the State, but

must be prepared to face the free and unrestricted competition of the highly perfected industrial organisations of the West. Under such circumstances, it is obvious how unequal, and on the whole losing, the contest must be for us in our own markets.*

(7) And, *seventhly* what is more serious, we have already the foreigner in our midst, fighting us out of the field, with his superior resources of knowledge and skill, capital and enterprise. He has already the start of us in more branches of industry than one. He is successfully getting hold of the general carrying and shipping business of the country; the tea and coffee industries, and the jute and silk manufactures, are in his hands; his banking business is fast extending, especially in the Presidency towns; and he is slowly, if not with equal success or persistent steadiness tapping our mining industry. Here is thus on our own ground a formidable antagonist with whom we have to wrestle; and we must never forget that he is both able and ready to step in wherever we choose or are compelled to retire.

These are some of the difficulties we have to face and surmount at the threshold if we mean to advance, and not fall back. These are indeed great, but by no means insuperable difficulties. They can be successfully got over by boldness and the vigour of our united effort. The practical question is, how should we go about the business in view of such a situation, and in prospect of such a large manufacturing development under Government auspices, so as to be able to assert our proper claims successfully?

It may not be out of place here to submit a few suggestions of ways and means for attentive and earnest consideration.

(1.) First of all, we must have the Government thoroughly with us heart and soul. Without its help in our present economic weakness and unpreparedness, we could hope to accomplish but little in the direction of national progress. In the face of such fierce competition as we are exposed to—Government must recognise the true wants of the nation and cordially identify itself with the cause of *national* industries. We must in our present state leave it to take the initiative, which we have neither the knowledge, nor the energy to take ourselves. It should collect, by its own professional agency, and publish in the Vernaculars, the necessary information regarding the manufacturing and mineral resources of the country. On behalf of the trading community Government should undertake initial experiments in the case of industries which might bid fair to thrive in the country, with a view to test their practicability and remunerative character. Government has already taken the first steps with reference to the Tea, Coffee, and Cinchona industries and can not have any reasonable objection to doing so in other cases. The chances rather are, that it would move of itself in this direction either from conviction of its necessity, or under strong outside pressure. All we should have to do in that case would be to appreciate the initiative Government might take, and follow it up with vigorous and independent efforts of our own, and not to suffer, by apathy or inaction, foreigner to come forward, and take advantage of it to our permanent detriment.

(2). In the *second* place, we must organise ourselves with a view to co-operation and associated action. In these days, without organisation there can be no vigour or sustained energy in our efforts at industrial development nor can there be any chance of success in a field where we have to meet our foreign rivals on such unequal terms. We must have a strong central native Chamber of Commerce for each Presidency at the Capital, with corresponding branch associations in the districts, with duties and functions similar to those of the English Chambers of Commerce in Bombay, Madras and Calcutta, and with adequate funds at their disposal. The Central Chamber should have a monthly Vernacular magazine in which to publish its proceedings.

It would not be difficult to start such an organisation. Already we have small native trading associations in Bombay, Poona and Sholapoor, which would form a good nucleus to start from. In other towns, too, the necessary elements exist and to establish associations, we have only to impress on the local mercantile communities the necessity for combination, and the practical aims it is sought to attain by it.

(3.) *Thirdly*, among other things, it should be the duty of such mercantile Chambers to collect, and to diffuse through the medium of the Vernaculars among traders and merchants information on matters of trade and industry, as well as on questions of taxation and Finance as affecting these interests. Ample information of this kind is always available in English books, Periodicals and papers, and in Government publications, and it would only be necessary to employ a staff of Translators, and pay for their labour, and for the publication of translations. The cost would not exceed a few thousand rupees a year, or, cheaper still, *precis* of such information might be published in the monthly magazine of the Central Chamber in each Province.

With a view also to create a general taste for, and appreciate interest in, such information, a step might advantageously be taken in the educa-

tion of the rising generation. A study of the elements of Political Economy, [as for example Mrs. Fawcetts's little book] in a vernacular translation, might be introduced into the curriculum of our Vernacular schools. In the large towns, these schools have, under the new Local Government scheme, now been placed under municipal management, and here the experiment may be first tried. Political Economy forms a necessary part of middle-class education in England, and as we believe, in other countries, and with very good results. If the geography of the present standards were reduced a little, the proposed study of the rudiments of Political Economy would be no additional burden put on the scholars, and the change would rather be a welcome one, as it involves the substitution of an interesting study for a comparatively dry one.

These two steps, namely, the diffusion of information among our traders regarding trade and economy by means of translations or monthly periodicals, and the introduction of a study of Political Economy into our schools,—are urgently called for in our present state of ignorance, for, without some reform in this direction, it is impossible to set on foot any bold industrial movement, or even to rouse a spirit of enterprise so as to lead to practical action. Nor is there any difficulty in adopting them. A magazine, if of sufficient interest, and conducted with ordinary skill and care, could easily pay its way; while the suggested change in our Vernacular curriculum would not be opposed by the authorities, or felt as a hardship by the learners and could be easily made.

(IV.) *Fourthly*, coming next to the want of technical training among our workmen, we must move Government to undertake it on a sufficiently large scale. There are industrial Schools and Colleges all over France, Germany, Belgium, etc., working with eminent success, and though they are not many in England, the want has been so urgently felt that practical steps will be before long taken to supply it. The subject has been lately investigated by a Royal Commission, and its final report is before the public. It recommends the establishment in the United Kingdom of a national system of technical education, pointing out its urgent necessity. Now, if this is so in England, *a fortiori*, it must be so in India, where national industries are so completely out of joint. The cost would, no doubt, be heavy, but if we wish to stand on our own legs, and hold our own in the industrial world in these days of general progress and cultivation, we must be prepared to pay for it. The object is of much paramount importance to the future material safety and welfare of the country, that any present burden or sacrifice which might be needed should be ungrudgingly, and even cheerfully borne with a view to its accomplishment. Government has already a well-organised Department of public instruction and can have no difficulty in taking up the additional duty of providing technical training.—*Hindu.*

CALCUTTA MARKET REPORT

FOR THE

MONTH OF SEPTEMBER, 1885.

IMPORTS.

An absence of general demand is still the leading characteristic of piece-goods market. The inundations have caused considerable disorganization in the Railway and other means of communication with Eastern Bengal, hence demand for that district has been less than usual at this season. Now, however, that the floods are subsiding and that there is a prospect of traffic being resumed before very long, it is hoped that a revival of demand may be experienced during the next few days. For the up-country districts there is as yet but little doing, dealers, however, seem to expect a good demand bye and bye.

EXPORTS.

Hides.—A very good demand has been prevailing in the Bazar during the first part of the month but as the floods which have not yet subsided, though the water is fast falling, have stopped the influx of supplies from the mofussil, business has been very limited. The break on the Eastern Bengal State Railway has shut off the imports of *Daccas* to this market. Arrangements are now being made to forward goods accumulated north of the break by boat and steamer, so that large arrivals are looked for at an early date; other sorts have come forward in small quantities, and have found ready purchasers at enhaced rates. Durbhunga, Patna, Purnea hides arrived in small lots, Burdwans, Hughlis are very scarce and much sought after. *Buffaloes* in very good demand and sell at high rates but are scantily imported. A brisk demand prevails for *Goatskins* and prices are rising.

Seeds, *Linseed.*—There is very little offering, and under a good demand, prices have attained an abnormal figure. The market is swept of supplies, and prices have been unduly forced up in consequence. At the close there are no sellers even at a very substantial advance.

Rape.—A very quiet trade at unchanged values.

Teel.—Advices from the districts promise an aver-

age crop; the reports continue favourable. Meanwhile there are no stocks in the market.

Poppy.—The market for this class of seed continues dull.

Castor.—The advices are confirmed which reported the Salem crop a failure. There has been a good demand during the fortnight, and forward sales,—October, November,—show a rise at the close. Sellers are showing a disinclination to do business at the current rates.

Castor Oil.—Has been in fair request and sales have been made at higher rates. Owing to the paucity of supplies of seed, the production of oil has been small and stocks are almost *nil.*

Rice.—Stocks of all kinds are light and under the influence of a local demand for the districts, prices generally are rising.

Wheat.—Continues in moderate request, but stocks are light.

Sugar.—Nothing doing.

Safflower.—No business reported.

Saltpeter.—Has been in brisk demand, and prices have advanced two annas. Torwards the close, however, a queiter tone prevails, and a decline may be looked for shortly.

Lacdye.—Nothing doing.

Shellac.—The market is unchanged, and but little business is being transacted. Holders are firm.

Cutch.—No business is reported, for forward delivery Rs. 11 are demanded.

Silk.—Nothing doing.

Silk piece-goods.—Market is active.

Jute Manufactures.—Since last mail a fair amount of business in heavy goods has been transacted at Association rates. For small parcels of favourite light twill goods even a slight advance has been paid for near delivery. The bulk of the orders placed is for local and country requirements and speculation.

Hessians.—Were well enquired after, but as these goods are getting scarce for October delivery, mills have raised their prices to a prohibitive extent. Quotations are the minimum rates fixed by the Mill Association.

Gunny Bags.—No demand excepting for local consumption.

Jute.—The floods still interfere with the working of the Eastern Railways, and supplies of *loose jute* are in consequence small. Prices mark a strong rise for good sorts and a less increase for ordinary kinds. No change is reported from the East Bengal Markets. The demand continues strong. Freights have risen, and their influence will no doubt make itself felt in a return to somewhat lower rates.

Baled Jute.—Can show no signs of activity as long *loose* continues as noted above, and balers are doing nothing further in the way of sales. *Rejections* are quiet and rates unchanged, *Cuttings* have registered an increase of four annas.

Indigo.—Advices from the Benares and *North-West* districts convey the information that the out-turn will be much below what was anticipated. In Behar operations are late, and no estimate can yet be formed of the probable yield.

Tea.—Public auctions were held on the 10th and 17th instants, when 26,845 packages were offered, of which 26,346 packages found buyers. At the sale of the 10th instant, there was considerable irregularity, fine and desirable teas, in some cases, realising full rates, while the bidding for common and medium sorts, shewed great lack of spirit and in these grades a decline may be quoted. On the 17th instant, there was good competition for the comparatively small quantity (10,592 packages) offered and previous rates fully maintained. Recent accounts received from the various districts are not favourable, more especially from Sylhet where very heavy rain has fallen. In Assam, the weather has been cold and wet and many of the gardens in this district are considerably behind in their out-turn.

C. K. Roy & Co.,
Merchants and Agents,
3, Ahiritola Street,
CALCUTTA.

CROP AND WEATHER REPORT.

For the Week Ending 9th September 1885.

GENERAL REMARKS.—In Madras rain in varying quantities has fallen in all districts, but more is urgently needed in several places, especially in Bellary, Coimbatore, Madura, and Salem. The reports from Bellary are very discouraging. Rain continues to hold off in Mysore; crops are generally reported to be withering, agricultural operations are at a standstill, and the prospects of the dry crops are critical and entirely dependent on a very early fall of rain. Fodder is becoming scarce, and the migration of cattle from Kolar into British territory is reported. In Coorg prospect continue favourable.

Slight rain has fallen throughout the Bombay Presidency, excepting Sind; but more is urgently required in several parts of the Deccan and Southern Mahratta Country, where fodder is scarce. In parts of Poona, Ahmednagar, Dharwar, Bijapur, and Belgaum the crops are withering for want of rain. They have been injured by floods and insects in parts of Karachi, by blight and worms in parts of Hyderabad, and by excessive rain in parts of Surat. In the Berars and Hyderabad rain is wanted for the standing crops, which are at present doing well. Rain has fallen generally throughout the Central India States, and the crops are doing well. In Manpur, however, rain is much wanted. In the Rajputana States rain has been almost general, and prospects are satisfactory.

In the Central Provinces agricultural prospects continue good; but more rain would be beneficial in Nimar and the southern districts, where the break has been of long duration. In the North-Western Provinces and Oudh rain has fallen in several districts; but a break has set in to the advantage of the crops, which have already suffered from excessive rain. Prospects are, on the whole, good. Moderate rain has fallen in most parts of the Punjab, and kharif prospects are generally good.

In Bengal rain has been fallen in all districts, and a break is now much needed for the crops. Excessive rain and floods have caused considerable damage in parts of Burdwan and the Presidency Divisions, and some injury to the bhadoi crops in places in Behar and Chutia Nagpur. Seasonable weather prevails in Assam, where agricultural prospects are generally good.

In British Burma ploughing and transplanting have been nearly completed.

Cholera continues in the Madras and Bombay Presidencies and in Raipur in the Central Provinces, and in some districts of the North-Western Provinces. Elsewhere the public health is generally fair.

Prices are rising in Bengal and Mysore; in the Punjab they are falling, and elsewhere they are generally steady.

Week Ending 16th September 1885.

General Remarks.—Good rain has fallen, both in Bellary and Anantapur, since the date of the last report. Migration continues from Alur, Bellary, and Hudjalli. In Salem and Coimbatore prospects are reported to have improved, but more rain is urgently needed in several districts in the Madras Presidency.

In Mysore there has been good rain in two or three districts, and more or less rain has fallen also throughout the State, though not in sufficient quantity to remove all cause for apprehension. It is hoped that a considerable portion of the standing crops will be saved if more good rain falls. Water and pasturage are still scarce, and the cattle are generally in poor condition. Future prospects depend much on further timely rain. In Coorg the season continues favourable.

Good rain has fallen throughout the Deccan and in parts of Bijapur, and the young crops have been much benefited thereby. More rain is still wanted in parts of the Deccan, and urgently in parts of Dharwar, Belgaum, Gujarat, and the Konkan, where the crops are withering. Fodder continues scarce in parts of some districts. In the Berars the standing crops are generally doing well, but more rain is wanted. In Hyderabad the rainfall of the week has been beneficial to the crops. In the Central India and Rajputana States there was little or no rain during the week under report, and it is much wanted in some places. Crop prospects are, on the whole, generally good.

In the Central Provinces rain is wanted everywhere, but especially in Nimar and Sambalpur. Preparations for the rabi have commenced. In the Punjab kharif prospects are generally good, but more rain is wanted in Ferozepore, Lahore, and Shahpur. In the North-Western Provinces and Oudh there has been a break in the rains, but prospects continue good.

In Bengal there has not been much rain during the week, and the cessation has greatly benefited the crops in many districts. In Orissa more rain is wanted. General prospects of crops are fair, except in inundated tracts in the Burdwan and Presidency Divisions and in Behar.

No reports have been received from Assam and British Burma.

The public health is generally fair in all Provinces.

In Bengal the price of rice has risen in several places, owing to excessive rain and floods. In the Punjab prices are fluctuating. Elsewhere they are generally steady, except in Sambalpur in the Central Provinces. In Mysore there has been no material change in prices. In one district, however—Kolar—they are falling slightly.

Week Ending 23rd September 1885.

General Remarks.—Rain is reported from all the districts of the Madras Presidency. In Bellary and Anantapur prospects have much improved. Elsewhere they are said to be fair, though more rain is required in most districts. In Mysore slight rain fell during the week in the Tumkur, Kolar, and Bangalore districts, but more is urgently required throughout the State, especially in the two districts first-named and in Chitaldroog. Agricultural operations have been resumed in some places, and the prospects of the season have slightly improved, except in parts of Tumkur, Chitaldroog, Shimoga, and Kadur. The cattle continue in poor condition, but pasturage is reported to be more plentiful.

Good rain has fallen throughout the Deccan and Southern Maharatta Country, and the condition of crops has been much improved. In most districts of Guzerat and in parts of Tanna and Colaba more rain is urgently needed. The kharif harvest generally promises well, and preparations for the rabi crops have commenced in places. In the Berars and in Hyderabad the rainfall of the week has been beneficial to the crops, which are generally doing well. In parts of Akola more rain is badly wanted. In Rajputana more rain is wanted in several States, but crop prospects are, on the whole, favourable. Rain is also wanted throughout the Central India States.

From the Central Provinces good rain is reported in the districts in which it was most wanted, and prospects have much improved. More rain is, however, very generally required. In the Punjab slight rain fell during the week. Kharif prospects are generally good, and agricultural operations for the spring crops have commenced in places. In the North-Western Provinces and Oudh the rainfall has been slight, and more rain is wanted, both for rice crops and rabi sowings. General prospects are, however, good.

In Bengal rain has been general, though fortunately less heavy than in previous weeks, and the cessation has been very beneficial. The bhadoi harvest is in progress, and late rice crops on lands not inundated are doing excellently. Floods have caused more or less damage in many places, particularly in parts of the Burdwan and Presidency Divisions. In Assam much rain has fallen during the past fortnight. In Sylhet crops have been much injured by floods, which are, however, reported to be subsiding. In the other districts agricultural prospects continue generally good.

In British Burma the weather continues seasonable.

The public health is generally fair in most Provinces.

Prices are fluctuating in the North-Western Provinces and Oudh and in the Central Provinces. In the Shimoga district of Mysore they are reported to be rapidly rising, and a slight rise has also occurred in Coorg. In Bengal the price of rice continues high. Elsewhere prices are fairly steady.

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AGRICULTURE, ARTS AND COMMERCE.

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THE most interesting feature in the administration report on the Government Cinchona Plantations, Nilgiris, for the year 1884-85, is the manufacture of the liquid extract of Cinchona by Mr. Hooper, the newly appointed quinologist. A gallon of the liquid extract was sent to Dr Cornish, the surgeon-general, for experimentation and his report is very favourable as to its therapeutic and keeping value. The quinologist has been ordered by the Government to produce another 1000lb of the liquid with the view of having it more fully tested. If future experiments prove the supposed usefulness of the liquid extract, it will be a great boon to the poorer clases of people. The great cost of manufacturing pure alkaloids forbids their being used on any large scale and the febrifuge now manufactured by Government though cheap is supposed to have the defect of producing nausea. The total amount of bark taken from the trees during the year was 118,017 lbs. Besides this there remained over on 31st March 1884, 92,526 lbs, making a total of 210,543 lbs. Of this quantity 84,880 lbs were disposed of during the year. The increase in the number of plants in the several estates on the 31st. March 1885, over that of the preceding year at the same date, was 144,182 in Dodabetta, 138,481 in Naduvatum and 220,315 in Hooker Estate.

Our readers may remember that a detailed account of the Bombay experimental trial made with steam machine for threshing wheat appeared in the April number of this journal. Since then it was submitted to the Government of Bombay by Mr Ozanne with a request that as the trial was very successful further experiments be sanctioned. The local Government has accordingly directed him to offer Messrs Balmer Lawrie and Co., the enterprizing Calcutta merchant who took the machines to Bombay and conducted the experiment last season, to bear half the expense of another experiment in Gujarat in the next season, with the promise to buy one small complete machine for the Bhadgaon Farm hereafter if the new experiment proves fairly successful. We shall watch with great interest the progress of the experiment likely to be taken in hand next season and hope to publish a detailed account of it.

In whole India there are ninety cotton mills, large and small, involving a capital of seven and a quarter crores of rupees, consuming annually 235 millions of lbs of cotton, and giving employment to 70,000 operatives. Of these there are forty-nine in the island of Bombay itself, twenty-four in the presidency of Bombay, nine in Bengal and the N. W. Provinces, and eight in Madras and in the Presidency of Madras. Some of the concerns are not working up to their full power ; a few combine with spinning and weaving some subsidiary processes, such as bleaching and ginning ; while others are in course of erection. Excluding these and basing the calculations on those concerns which are in normal working order, we find that in the year ending 30th June 1885, there were in the island of Bombay nineteen mills devoted to spinning cotton alone, and twenty-two employed in spinning and weaving together. The nineteen

spinning mills employ between them 12,231 men who work up annually 59,781,216 lbs. of cotton, which gives an average of 4,840 lbs. per man. The twenty-two spinning and weaving mills employ between them 24,931 operatives, whose stock of work was 108,509 candies of cotton equal to 85,071,056 lbs or an average of 3,412 lbs per man. Dividing the mill located in the Bombay presidency into similar groups, namely, those that spin only and those that both spin and weave, we find that in the former group there are six mills and in the latter thirteen, the former working up 11,275 candies or 8,839,6000 lbs of cotton with 2,810 men and the latter 23,510,592 lbs with 8,503 men. This gives an average of 3,145 lbs and 2,764 lbs respectively against 4,840 lbs and 3 412 lbs the averages realised by the concerns in the Presidency city.

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From a tabular statement showing the destruction of human and animal life by wild animals and snakes during the year 1884 as compared with the previous year. it appears that there was a slight decrease in the former. The number of human beings killed was 22,425, as against 22,905. On the other hand the number of cattle killed was 49 672, against 47.478. The decrease in the loss of human life was general throughout India, except in Bengal, Burma, and Kurg. The number of deaths caused by wild animals was 2,795 as against 2,838, of which 59 were killed by elephants, 831 by tigers, 229 by leopards, 114 by bears, 265 by wolves, 32 by hyenas, and 1,266 by other animals. The number of deaths from snake-bite were 19,629, as against 20,067. Of the cattle killed 47,494 were killed by wild animals and 1,728 by snakes. Bengal heads the list with 12,397 animals killed, Madras follows with 9,065, in the North-West Provinces and Oudh 8,409 were killed, next comes Assam with 6,670 and then the Central Provinces with 4,372. The losses in the other provinces, though somewhat serious, were but trifling compared with the above. Tigers and leopards are by far the most destructive of the wild animals, as the former killed 19,680 and the latter 19,699 during the year. The number of wild animals destroyed was 23,775 as against 19,890, whilst the number of snakes killed fell from 412,782 to 380,981. The amount given in reward for the destruction of both wild beasts and snakes was Rs1,74,355, the increase being due to the larger number of wild animals for which rewards were paid. In the Rungpur district of Bengal alone 465 tigers were killed by professional shikaries.

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The report on the loss of cattle by tigers and leopards is the subject of a leader in the Madras Times. It must be admitted that tigers and leopards generally have better chances of seizing oxen than of seizing other animals; for while some of the other animals seldom leave the neighbourhood of the village, bullocks and cows are taken to the verge of forests and sometimes into them to graze. This happens with sheep and goats also, and perhaps to a greater extent during some parts of the year; but these animals keep together more and are less apt to stray; they are tended by a larger number of men, and are guarded by powerful dogs, and, if penned at night in or near the forests, generally have strongly built folds of stone, so that they are safer really because they are much weaker and more helpless than cattle and are therefore better protected. Buffaloes also are, when there is no cultivation in the fields, sent out to graze; but they move more slowly than bullocks and cows, and are less choice in their food; and they therefore are not taken so far away from the villages to graze. But with every allowance for the greater facilities that tigers and cheetahs may have of seizing bullocks and cows, we fear that the number of slain among the latter, put down to the former, is far too great. We know for a certainty that not every bullock or cow that is lost has been seized by a wild beast. For the lower caste Indians who eat the beef, and sell the hides probably have more hand in the matter than tigers and cheetahs. In Madras the pariahs and chucklers resort to poison, when their desire for flesh is strong in them; but where hollows and nullahs, thickets and scrub abound, the knife is used, and the carcase is concealed till night, when it is cut up and brought home by a set of cattle-killers. In Bengal the the cattle are frequently poisoned by the lower caste people mainly for their hides, sometimes for flesh also. It would be well if village officers who record the loss of cattle were required to take some measures for ascertaining that they were really killed by wild animals, before attributing their death to that cause, and in cases where nothing is known of the cause of their disappearance, they should simply be reported as lost. For not only do low caste people kill and steal them, but dishonest drovers sometimes sell them to wayfarers from distant parts or to beef-eaters in their neighbourhood.

The following extract from the *Manchester Courier* of the 30th October will interest our readers. Amongst the proceedings of the Chamber of Commerce yesterday was the reception of a communication from the Bengal Chamber giving the real lengths of 10 pieces of shirtings taken out of

a bale whose contents were stamped 38 and 38½ yards. These pieces averaged 36 yds. 14 in., or only 5 in short of a deficieny of two yards each. That goods are now systematically made short widths, short lengths, and reduced in picks and reeds, is no secret but has been public enough for sometime to permit previous references to these practices. Such have, indeed, been made more than once in these columns. But the formal complaint of the Bengal Chamber of Commerce to the Manchester Chamber of the "system of stamping goods with lengths which the pieces do not contain," and the "hearty concurrence of deprecation" expressed by the latter, are calculated to excite some surprise amongst those conversant of its existence. The Bengal Chamber of Commerce could on their part have easily discovered who shipped these goods, who made them, and, with little trouble, have also discovered whether the consignee was absolutely overwhelmed with astonishment when he found that goods supposed to average 38½ yards were in reality nearly two yards short; and on the other hand although not a member of the Manchester Chamber of Commerce, may have heard of the tactics which now excite its reprobation. The custom is only too well known in Manchester. In such cases as the present the universal but pitiful plea is that no one is really deceived. But to a superficial observer something very like fraudulent misrepresentation is unavoidably suggested.

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The *Daily Chronicle* of the 15th September has the following paragraph;— "Two singular features in the jute trade are reported. The ship *Falls of Dee*, which arrived in the Tay on Saturday from Calcutta had on board as part of her cargo, 110 bales of jute gunny bags. This is said to be the first direct importation to Dundee of manufactured bags from Calcutta and the fact that 80 tons of these goods have been sent from India to the head-quarters of the jute industry in this country is considered to be a proof of the keen competition now carried on in the jute trade. It is also reported that a Dundee jute merchant has exported, or is about to export, a quantity of jute to Calcutta there being at present a scarcity of jute at the Indian port and a glut of it in Dundee, where the price of the article is much lower than it is at Calcutta, its original port."

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The principal rail-borne trade of the North-Western Province and Oudh during the quarter ending the 30th June last, was carried on with Bengal, Rajputana, Central India, Panjab, and the Bombay Presidency. But by far the largest trade was with Bengal, with 61·4 per cent. of the total, whilst that with Bombay was 5·1 per cent. The season so far as regards grains, was, on the whole, a fair one, the barley, pulses, and most of the wheat crop being gathered in good condition. Linseed also yielded a bumper crop in parts of Oudh and Rohilkand, but the mustard and rape crops were almost failures. The quantity of wheat exported was 2,542,707 maunds, an increase of 1,089 859 maunds over that of the previous year and the increase was almost entirely in the Calcutta trade. Linseed nearly trebled in export, and again the increase was in Calcutta trade, whilst there was a decrease in the export of rape-seed from Allahabad to Calcutta, and from Agra to Bombay. As regards the other goods exported, cotton, sugar, and ghee, the quantities were nearly the same as in 1884, and the same may be said of the principal items of import, cotton goods and metals.

The returns of the rail-borne trade of the Bombay Presidency during the quarter ending 30th June are published. As these returns relate to the busiest part of the year, the traffic shows a remarkable improvement over the other quarters. Similar improvement has consequently taken place in the exports by sea from Bombay to foreign countries of wheat, linseed, rape-seed, gingelly-seed, groundnuts, myrabolams, and poppyseed. The entire trade of the Presidency during the quarter of review was 23,403,280 maunds. Compared with corresponding quarters of the year 1883-1884 and 1884-1885, the traffic shows an increase of 12 and 7 per cent respectively. To the total trade the imports from the external blocks contribute 46·1 per cent., the exports to those blocks 11·8 per cent. and the local trade 42·1 per cent. The trade under the first head is composed of 10,408 387 maunds of principal and 389,553 maunds of minor commodities. Amongst these wheat, oilseeds and the corresponding grains, other than wheat and cotton raw, form the bulk of the trade. Compared with the figures of period of last year, the imports show a small decrease in the case of wheat and cotton raw, but a considerable increase in oilseeds. The increase over last year's figures under the second head amounts to nearly 325,00 maunds. The exports consisted of 2,045,456 maunds of principal and 703,061 maunds of minor commodities. Compared with the imports from the external blocks, the exports to them stand in the proportion of four to one. A comparison of these figures with those for the corresponding quarter of last year shows that the traffic in coal, gunny bags, and tobacco has fallen off, while

that in cotton goods, metals, salt and sugar has increased.

The Ceylon Tea industry is advancing by leaps and bounds. Export last year was 2,250,000 lbs. For this year the estimate was 3,350,000 lbs. ; that figure has been realised with a week or two of the season still to run, and the total shipment will probably be nearer 4,000 000 lbs. The outturn next year is expected to be 7,000,000 lbs., a quantity which must have an appreciable effect on prices in London. It is time for Assam planters to recognise the fact that they cannot afford to despise their new competitor in the South. Ceylon is much nearer England than China or Japan. It has an area of good tea-growing country supposed to be equal when fully utilised, to an annual yield of seventy or eighty million pounds, and a climate far better suited for out-door work by Europeans than almost any other in the East. These are great advantages ; and, if energetically turned to account may in a few years give Ceylon tea a position in the English market which will make shareholders in Indian companies more anxious for their dividends than ever.

The decennial report on the moral and material progress of India is the subject of a leader in the *Times*. In analysing its details, it is remarked that "the trade of India has grown enormously, during the period to which the report refers. If we look back for forty years, we find the total imports and exports of India amounting together to not quite twenty-five millions sterling. They now exceed a hundred and fifty millions. The late growth of imports and exports is shown in detail by a series of comparative tables which tell us what they were in 1873-74 and what they had come to be in 1882-83. Among imports, the most striking figures are those which relate to manufactured cotton goods. These have risen from about fifteen millions to almost twenty-one millions and a half. On the side of exports the growth has been shared among a large variety of articles. The Indian cotton has risen to about twice what it was in 1873-74. The export trade in wheat has been almost literally the creation of the last nine years. In 1873-74 it stood at £827,606. It stands now at upwards of six millions. In jute, both raw and manufactured, there is a satisfactory increase shown. Seeds have risen from about two millions and a quarter to about seven millions and a quarter.

The Government of Mysore intend to open the irrigation works in the Province to improve the revenue. It is proposed to work out the Maicknava in the Chitaldroog District, at a cost of Rs.75,000. If this project were to be worked out, the water can be irrigated to a length of 140 miles in the taluks of Hosadroog, Seera, Chellakera and Chitaldroog. This, of course, is not only to be a source for the increase of revenue to the State in its present financial difficulty, but would be of greater importance to prevent the famine. This scheme was once attempted during the British adminstration in the time of Sir Richard Mead, the Chief Commissioner.

The Mysore Dewan has sanctioned the introduction of the Arabian date tree, which is to be cultivated as an experimental measure in the province. Steps have been taken, through the British Consul in the Persian Gulf, to obtain a supply of the proper variety of the date palm, and it is expected that 400 or 500 young shoots will arrive shortly. The date palm, which grows luxuriantly in localities that have a scanty rainfall, will, it is hoped, do well in the Chitaldroog and Kolar districts and part of Tumkur, where the rainfall is precarious and far below the provincial average. Should the experiments turn out a success, and the cultivation be largely extended, it will prove a standby in times of scarcity. Old records show the Arabian date flourished in the Lal Bagh many years ago, but the trees were either cut down or allowed to perish from neglect.

At the instance of the Madras Government, the Calcutta authorities have sent an experienced Benggallee artist-modeller from the school of arts here to the Madras school of Arts to take models of the distinctive classes of natives peculiar to this Presidency. Already four or five models have been taken, among them one of the Madras boatmen. These, with a few more still to be taken, will be draped in costumes peculiar to their respective classes, and despached for the coming London and Colonial Exhibition of 1886.

A number of the largest guarantors of the proposed Bombay International Exhibition have sent in a memorial to Government praying that the guarantee fund be cancelled. The memorial is signed, amongst others, by Sir Munguldas Nathoobhoy, the Hon Rao Sahib Mandlic, Mr. Dinshaw Manockiee Petit and his brother, and Mr. Sorabjee Saperjee Bengali.

Messrs. Collyer and Co., of London, have reported as follows on the samples of fibre prepared in the Government Farm at Saidapet from Manilla hemp plantain and the common plantain tree which were submitted to that firm for valuation:—Musa textilis (Manilla hemp).—Good length, good color, fairly clean, but mostly deficient in strength; fibre fine, but very brittle, value probably about £30 per ton. This sample is superior to most of the samples sent from Southern India, but is much inferior to the Manilla hemp grown in the Philippine Islands. Musa paradisiaca (common plantain).—This sample also is superior to many we have seen, being good length, fair dullish color, fairly clean, varying strength, mostly brittle and weak; if fully equal to sample would probably realise £25 per ton. The great bundance of superior fibres in this market renders the sale of any similar to above very difficult except at very low prices; they will probably be more valuable for local use, and we have also reason to believe that if spun upon the spot whilst the fibre is fresh before it gets thoroughly dried, a rope can be made much more durable and much stronger than the same fibre would produce if spun here.

The opinions of experts regarding the value of the seed pods of the babul tree (accacia arabica) as a commercial product are published in the *Bombay Government Gazette*. Tinctorially the substance is not regarded as of any value, and it is only useful in dyeing on account of the tannic acid which it contains. Comparing the seed pods with sumac, galls, or myrobolams, they contain only a very small percentage of tannic acid. The price of sumac being £16 per ton, these pods would not be worth more than £9 or £10 per ton. It is suggested that the best way to make this product useful would be to extract the tannin from it where it grows, and as probably the bark, and even the branches, of this accacia may contain more tannin than the seed pods, all could be boiled down together, and a better average yield of tannin obtained.

The development of the wheat trade of India which has a great future in store depends largely on producing a proper marketable sample. It is known to all who are interested in the question that Indian wheat fails to get its proper price in English and European markets owing to its bad sampling. It is a heterogenous mixture of good with bad, hard with soft, and red with white grains, besides foreign seeds and other extraneous matter. Attempts are being made by the Indian Government in all their agricultural departments to remedy this evil. Enquiries have been set on foot to determine the cause and agricultural authorities asked to suggest remedies. From the information collected by Mr. Ozanne, the Bombay Director of Agriculture, it seems to be almost certain that, at least in that Presidency, soil, climate and rains do have some influence in changing hard wheat into soft but whether they have any influence in changing the color seems to be doubtful. A few experiments conducted in the experimental Farms in Bhadgaon and Khandesh tend to show, in the opinion of the Superintendents of the above farms, that climate and soil have some influence in changing the color in common with the texture of the grains. The information gathered on this head by Babu Lachman Pershad, the able and experienced Superintendent of the Cawnpur Agricultural Station is that *matyar* land (heavy loam) and canal water have a tendency to tinge white-wheat red. The grounds for the above assertion made by the kachhis who were consulted seem to be that red-wheat is grown in Bundlekhand where *matyar* land prevails and that canal water is not so good as well-water. To test the accuracy of the infomation given by the local Kachhis, some experiments were conducted by the able Superintendent. A field of clayey soil close to the Cawnpore Agricultural Station was sown with hand-picked white wheat. On threshing out the crop, the grain was inferior in appearance and color to the original seed. The effect is supposed to be due to the pressure of iron salts in which clay soils are generally very rich. The fact that white wheat in certain soils reverts to red in color is a matter of common knowledge in most districts.

Mr. Fuller, the Director of Agriculture in the Central Provinces, has got no grounds for believing that the color of a variety of wheat is altered by a change of climate or soil. Nor the people there have any such belief. He, however, acknowledges that he has had no opportunities of making enquiries respecting irrigated wheat and it is irrigation, he believes, which is supposed in some places to effect a change of color in wheat grain. The infomation gathered by the Agricultural Department of the Punjab is however more definite. It is stated that in a few districts good wheat, if cultivated without care, and under conditions of soil, irrigation, etc., unsuitable to it, will by degrees degenerate into a red wheat and that scarcely any instances are known of the improvement of a red to white by superior husbandry. In conclusion we might also quote a few lines bearing on this point from Mr Ozanne's Report. "The Superintendent of both

farms (Bhadgaon and Hyderabad) are of opinion that both color and consistency are liable to change. A remarkable instance may be quoted. The steam thresher which was tried this year worked in the district of hard wheat and yet a sample sent to the Chamber of Commerce was not recognized as such. Indeed it had become a mongrel admixture of hard and soft grains in every stage of consistency. If the causes of admixture are as not unlikely what they are belived to be, to find out a remedy for the evil will tax the brain of our ablest agricultural reformers.

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Mr Bhupal Chunder Basu, one of the Bengal Agricultural Scholars who passed out of the Royal Agricultural college at Cirencester with distinction and afterwards took the first place in the Diploma Examination of the Royal Agricultural Society of London, in virtue of which he was elected a life member of the Society, is now on a agricultural tour on the Continent, for which he has been granted an extension of scholarship. After presenting himself at the British Embassy located in Paris whence he secured introduction to most of the agricultural heads of France, he has been walking over the ground of agricultural practice and agricultural education throughout France and Belgium and reporting his observations and experiences to the Secretary of State for India in London. We reproduce some of those reports in another columm from which our readers will learn what profitable use he is making of the time at his disposal and the money spent on him. The vivid picture which he draws of the condition of the agriculturists of parts of Brittany and the causes which he assigns for it, are the most interesting parts of the report. The "earth-hunger "of the French peasants as he quaintly puts it together with minute division of land property incident to French law of inheritance and dread of emigration, have been the ruination of the Breton agriculturists. Have not the very same causes made our ryots a total wreck ?

It may perhaps interest our future Agricultural Scholars to know that the fees payable at the Royal Agricultural College at Cirencester are now considerably higher than they formerly used to be. The fees charged by the college were formerly £20 per term or £60 per annum and when the scholarships were first founded in 1880, £200 were estimated to be just barely sufficient to cover the expenses of a student including his fees, board, lodgings, etc. Since then the college has raised the rate of fees from £60 to £75 a year but the amount of scholarship, *viz.*, £200 a year, has not been similarly increased. With the additional drain of £15 a year on the limited funds placed at the disposal of a student living in a foreign country far out of the reach of helping hands, he has to observe economy at the sacrifice of utility. A new and third drain has again very recently been opened on his already over-drained pocket. The new batch, provided one is sent next year shall have to pay an additional £5 as entrance fee. If the scholarship be continued, the Government should take into consideration the facts stated above and increase the grant from £200 to £250 per annum.

The sugar cane planters and sugarcane-manufacturers of Mauritius have been rather frightened at the prospect of the British and European market being closed against Mauritius sugar. The bounty-fed beet sugar of Germany and other States of Europe have lately been underselling Mauritius cane-sugar in British market and the islanders are looking forward to India. It is perhaps not commonly known that the islanders do not use animal charcoal in the manufacture of their sugar and they are trying to impress this fact on the Hindus of India who have strong objections against using sugar purified by bone-charcoal. They propose to receive a deputation from India of men who possess the confidence of their fellow countrymen and who after having inspected the factories in Mauritius could, on their return to India, give an authentic report of their method of manufacture.

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The dearth or almost total absence of any information on the composition and feeding value of ordinary Indian food-grains, invests the analyses of husked and unhusked rice, given in the report of the Chemical Examiner to the Government of British-Burma, with greater importance than they otherwise would have had. The samples analyzed were grown at the Alon Government farm under known conditions of manuring and cultivation. We reproduce here the analyses of the grain which was manured with bone-dust in 1883 and 1884 and another left unmanured both the years.

	Bone-dust, 1883-84.	Two years unmanured.
Oil	3·310 ...	... 4·93
Gum (alcoholic extracts) ...	1·930 ...	... 2·24
Albuminoids (soluble in water)	2·226 ...	... 2·35
Starch	73.134 ...	... 66·72
Albuminoids extracted by alkali	10·430 ...	... 13·20
Cellulose	8.937 ...	... 10·78

It will be observed that the unmanured sample gives a much better anaylsis than the manured one so far as albuminoids and oils are concerned, although it is rather deficient in starch. Considering the relative rates of the feeding values of albuminoids, oil and starch, the decrease in the percentage of albuminoids and oil in the manured sample shows a considerable diminution in its feeding value. Albuminoids and oils have far higher nutritive value than starch and it is of importance to notice that both of them decreased by manuring with bone-dust. There is one item however wanting in the two analyses which are quoted above, *viz.*, the percentage of ash, the influence of manure on which we should have liked to see in the table. Besides if we add up the figures in the second column, we find that there is no margin left for ash. This does not speak much in favour of the accuracy of the analysis.

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From the returns of the railway-borne traffic of the Central Provinces for the quarter ending 30th June 1885, we learn that compared with the corresponding period of last year there was a decrease in export, amounting to 19 lakh maunds. This was principally due to a very marked decrease in the exports of cotton and wheat. Only 6,988 maunds of cotton were exported against 39,509 maunds in the corresponding quarter and the export of wheat fell off by 11 lakh maunds. The deficiency in cotton crop was the result of the almost total failure of the crop of 1884. The principal items of imports of the quarter were salt, sugar, cotton goods and metal. The large increase in the amount of sugar was due to an increase in the sugar which was received from the North-Western Provinces. The principal items of export for the quarter under notice were wheat, rice and linseed, in all of which there was a falling off. Compared with the corresponding quarter of the preceding year there was a falling off of eleven lakh maunds in wheat.

The report of the railway-borne traffic of the Central Provinces for the year 1884-85 is published. The total imports amounted to 36,07,974 maunds and exports to 1,82,74,720 maunds, valued respectively at Rs. 2,86,52,722 and Rs. 3,96,65,493. Comparing these with the figures for the preceding year, a decrease is noticed of 16 per cent. in the amount and 27 per cent. in the value of imports, an increase of 9 per cent. in the amount and a decrease of 28 per cent in the value of exports. The decrease in the amount of imports is due to a general falling off in the traffic under almost every principal head except salt. The increase in the weight of exports is ascribed to a great expansion in the wheat traffic which exceeded that of the year preceding by 20 lakh maunds, while the value decreased by nearly a crore and a half rupees. The decrease in value of both imports and exports is not however so much as it seems at first sight, the difference resulting from the non-registration of " Treasure." The principal items in the import traffic were coal, cotton twist and yarn, cotton piece goods, gunny metals, salt, sugar drained and undrained, and tobacco. In the imports of cotton-yarn, the Indian goods show a large increase. The imports of Rajputana salt decreased considerably, sinking from 123,996 maunds in the preceding year to 34 421 maunds. The import of drained sugar shows a considerable increase which is chiefly due to a large rise in the import of Mauritius sugar from Bombay which seemed to be gaining ground at the expense of the produce of the North-Western Provinces and Behar. This would be very reassuring to the islanders who, finding the British market closed against their sugar, are looking forward to India for the expansion of the trade with Mauritius sugar. For undrained sugar, as before, the North-Western Provinces and Behar continued the main sources of supply. The imports of tobacco from Bengal also decreased. Of the Export trade,—coal, cotton, wheat, rice, hides, linseed, tilseed, myrobolams, stick lac and ghee form the principal items.

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The expansion of the export traffic in wheat is the most striking feature in the trade of the year. It exceeded the export of 1883-84 by 20 lak maunds and was 3 lakh maunds in excess of the export of 1881-82, which has hitherto been the largest on record. The total amount exported (nearly 98 lakh maunds) represents the produce of at least 14,00,000 acres or 41 per cent. of the total recorded wheat area of the Provinces. It must not, however, be understood that the quantity of wheat exported really represents the actual surplus. Any one having the least knowledge of our ryots need not be told that they are not unfrequently obliged to sell off their crop no sooner it is harvested inorder to pay the landlord and the mahajan. These mahajans are very commonly paid in kind. For the seeds supplied in the sowing season, the mahajans' demand at the lowest stands at twice or three times the quantity of seeds supplied. Then again the time in which the ryot sells his wheat to meet the demands of his creditors is not generally the time in which he can sell to advan-

tage He can not store it in expectation of a better market. To add to this, when the market price rises a little higher then usual, he can hardly resist the temptation of making some profit, even if sufficient store be not left to carry him through the year. More wheat in common with all other grain crops thus finds its way into the hands of the grain-dealers and exporters than what can be really called the surplus of the country. The export of hides deserves some notice, it doubled itself during the year. This was mainly due to the unprecedented mortality of cattle in the Chhattisgarh Division during the rains of 1884, when an epidemic of *apparently* pleuro-pneumonia carried off cattle in thousands. Nearly half the quantity of hides exported was subscribed by the Chhattisgarh block. Reinderpest was also prevalent in parts of the Nagpur Division and the exports of hides from the Nagpur block rose from 12,114 maunds in 1883-84 to 22,112 maunds last year. The increase in the amount of export of hides exported from the above two divisions represents an increase in cattle mortality amounting to about 13,000 in the Nagpur and 1,31,000 heads in the Chhatisgarh block.

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To any one not conversant with the singular apathy of both the people and the Government towards the disease of cattle and cattle-mortality in India, it would appear very strange that a disease which carried away more than a lak of cattle in a comparatively very small area should be left undiagnozed and put down as *apparently pleuro-pneumonia.* Be it not understood that this supreme ignorance of the nature of contagious diseases which are carrying away every year millions of cattle from all parts of India, is peculiar to the Central Provinces alone. Excepting Madras in which attention has latley been directed to the subject, the share of all other provinces in this ignorance is almost alike. We need not repeat what we have on many occasions shown in these columns, of what paramount importance it is to the agricultural improvement of India to have an organized branch of the Agricultural Department to investigate the nature of cattle-diseases and find out the remedies for their prevention.

The Nagpur Experimental Farm though only in its formative stage now, yields ample evidence of having in its constitution elements of future healthy development. The crops grown last year were cotton of various kinds, maize, juar, wheat, linseed, gram, sugarcane and Italian turnips. A few manure experiments were tried from which it would be unwise to deduce any general inference, but so far it has been found out that manures not containing nitrogen are of relatively small value in the farm soil. The most interesting part of the experiments conducted were those with agricultural machinery, a detailed description of which may interest many of our readers. But as we are hard pressed for space in this number we reserve it for the next.

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1. Report on the Experimental Cultivation of Guinea Grass; From Government of India.
2. Memoranda on the Prospects of British Burma Rice Crop and Bombay Cotton crop: From Government of India.
3. Experiments with a Steam Threshing Machine in Bombay: From the Director of Agriculture, Bombay.
4. Administration Report on the Government Cinchona Plantations, Nilgiris: From Government of Madras
5. Memoranda on the Disposal of Livestock of the Saidapet Farm, on Veterinary Hospital Accomodation at the Saidapet Farm Buildings, on the Work of the Madura Farm, on "Cassateto" and "Gratteuse", on Experiments on Musa Textilis supplied by the Saidapet Farm, in the Central Provinces and Bombay Presidency, on the Extent and Limits of Saidapet Farm, on the Preparation of Coca-plant Leaves for the Market, on Lacrise Sucriere, and on Mofussil Inspection of Cattle Disease by Mr Mills: From Government of Madras.
6. Memorandum on the Sugar-cane Crisis at Mauritius: From Government of India.
7. Trade and Navigation Report for the Month of September: From Government of India.
8. Internal Trade of Bengal with Sikim, Nepal and Bhutan: From Government of Bengal.
9. Railway-Borne Traffic of the Central Provinces for the Year ending 31st March 1884 and for the Quarter ending 31st June 1885: From the Director of Agriculture, Central Provinces.
10. Report on the Agriculture of France, by B. C. Basu, Bengal Agricultural Scholar: From Government of India.
11. British Burma Gazette for November: From British Burma Government.
12. A Pamphlet on the "Re-searches on Silk Fibre" by T. Wardle: From Government of India.
13. Rangoon Gazette for October 30th; From Manager.
14. Journal of the Agricultural Students' Association: From the Secretary.
15. Agricultural Students' Gazette for August 1885: From Editor, Cirencester.
16. The Inaugural Address delivered in the University of Edinburgh, on Wednesday, 29th October, 1885, by Prof. Robert Wallace. From the Author.
17. Prospectus and Syllabus of the Agricultural Education in the University of Edinburgh. From Prof. Wallace.

The Thanks of the Editor are recorded for all the above Contributions.

IRRIGATION ON THE SCHOOL FARM AT LEZERDEAN, FINISTERE.

[BY B. C. BASU, BENGAL AGRICULTURAL SCHOLAR, On tour on the Continent.]

THE school of irrigation and drainage at Lezerdean is an intermediate agricultural school and belongs to the category of Ecoles pratique, of which there are several in France. It is however much superior to its fellows on account of its speciality in irrigation and drainage, as its name implies. Of the school itself, I have very little to say, the system of education is almost the same as at Grignon; theoretical studies may not be so deep but practice in every thing is rigorously insisted on. As regards irrigation and drainage, the teaching is here more complete than elsewhere.

Monsieur Baron, the Director of the school, is at the sametime the tenant of the farm itself; he has also rented two adjoining farms and the three together form a compact occupation of about 250 acres. It is however on the school farm that meadows have been laid down to irrigation. Before describing the practice in detail, it will be better to glance at the aspects of the country, its soil and climate as these bear very largely on irrigation.

The country about Lezerdean partakes of the characteristic mountainous nature of Finistere. The table-lands more or less extensive are split through by deep gorge, often with almost perpendicular sides; the excess of rain which has fallen on the uplands collects into narrow brooks which rush impetuously along the bottom of the valleys. The whole landscape is indeed that peculiar to primary formations. The basis of the soil is granite intercalated with very extensive veins of quartz and amphibole. It is sandy or clayey according as quartz or felspar is the predominating factor of the granite from which it has been formed. On the school farm the soil is almost of a very light sandy nature and rests on a bed of impervious clay. The soil of the locality is unusually very deep, unless on the steep flanks of valleys, or where otherwise it is exposed to considerable washings. Chemically the soil is unusually rich in potash, derived from the original granite; on the other hand it is naturally almost wholly destitute of the two other elements in which primary rocks generally fail, *viz.*, lime and phosphoric acid, substances indispensable to plant growth. The consequence is that agriculture is impossible without treating the soil with considerable quantities of lime and phosphatic manures; in its normal state, the soil supports only dense growths of ferns, heather and broom. These latter die and decompose and thereby give rise to an unnatural quantity of acid substances in the soil. From analyses made at the Laboratory at Lezerdean it appears that on some soils in the neighbourhood of the school, fully two per cent of carbonate of lime would be required to neutralize their acidity. This when put into proper figures, means an addition of 50 tons of limestone per acre for the first 10 inches of the soil. This fact has an enormous bearing on the agricultural enterprize of the district, and I shall have occasion to speak of it later on in its connection with the *petite culture* of Finistere.

From its vicinity to the sea, the climate of Finistere is very temperate, being directly exposed to the moist south-westerly winds from the Atlantic, it is moist and cloudy. The rainfall averages about 40 inches *per annum*. Unlike the south of France, droughts are unknown here and consequently irrigation has much less significance in Finistere.

The system of meadow irrigation at Lezerdean is known as *Irrigation per simple diversement.* In England it is known as the catch-meadow or Hill side irrigation; it finds a very limited place, however, in British Agriculture. It is only possible, as its name implies, on the side of hills or on lands having a sufficient slope. The source from which water is derived most commonly is springs, as at Lezerdean; sometimes brooks, common enough in hilly district, are perfectly adapted to being utilized for watering the lower slopes. The geology of Finistere with its alternating beds of sand and clay, broken through by quartz veins, is particularly favourable to the growth of springs. These either come up to the surface or, as is most commonly the case, lie underground, where they betray their presence by a green moist appearance of the herbage above them, or very often by growths of rushes, sedges and various other semi-aquatic plants. The manner of utilizing these springs when once discovered is very simple. At Lezerdean, the springs are very shallow, probably not deeper than the first layer of sub-soil clay: they debouch mostly at the surface; when under-ground, they have been tapped by digging into their hearts. The issuing water is collected in a reservoir in the neighbourhood, often immediateley over the springs. The construction of such reservoir is very simple; Lezerdean, however, at the State cost has gone into considerable expenses to give them more durability than is usually their lot. The principle in any case is the same as will be seen from diagram appended to the report (Fig I.)* It represents the position of a reservoir with its primary rigoles which carry away the waters to be distributed over the meadows. The dotted colour-lines show the respective altitudes of different parts of the land. It will be seen that the right

*This as well as other diagrams referred to in this sketch have been omitted. Ed. I. A. G.

portion of the land at the top has much less slope than the corresponding portion on the left side. Such failures of slope on hill sides favour the growth of moist patches, which often degenerate into bogs and marshes, phenomena not very unfrequent in hilly districts. To render such land healthy, it has to be drained, as shown in the diagram. The main drain debouches into the reservoir, and so far it plays the part of a spring. Besides this, two springs s, s, have been shown at higher levels, they have been tapped and their water led into the general reservoir. Three other springs have been represented at the bottom of the reservoir, ; these from the main sources of supply. As to the construction of the reservoir, it consists simply in barring across the face of the valley, as is apparent from the figure. Some care is necessary in the building of the embankment in order to make it water-tight, a task which is not always easily or satisfactorily performed. At Lezerdean all embankments have been made of solid masonry, regardless of all expenses which such a luxury would entail. But where economy and not luxury has to be studied, it would answer equally well to build them with ordinary materials found on the spot, taking care, however, to put always a certain thickness of impervious puddle in the interior of the bar. In all cases, the foundation of an embankment should always be, in an impervious stratum, however deep it might be necessary to dig to get into it. The primary *rigoles* originate at the lowest part of the reservoir, the delivery is regulated by a *vanne* or sluice on the side of the embankment. Above the primary rigoles, two smaller rigoles may be seen, these are mostly unnecessary, their only function being to water the strip of land which lies between themselves and the primary rigoles. A certain slope is always necessary in the rigoles to facilitate the flow of water, it is usually ·002 in the primary rigoles; but the slope varies according to the dimensions of the rigole as well as the object it is intended for.

So far I have sketched as briefly as I could the source from which the water is derived, the formation of reservoirs and primary rigoles and their general disposition with regard to each other. I have omitted all minor details, as these would only serve to encumber the report. I will now try to describe how the water which has been led away by a primary rigole is distributed over the soil.

It is evident from Fig. 1 that only those fields which lie below the primary rigoles are accessible to irrigation. When water flowing in a conduit traced horizontally on an inclined slope is suddenly arrested, it accumulates behind the stoppage and eventually *diverses* itself *i. e.* overflows the lower lip of the conduit. This is the sole principle of the hill-side system of irrigation. There is a good deal of diversity in the formation and tracing of the rigoles of diversement.

For lands of average inclination of which the slope does not exceed 1 ($\frac{1}{8}$), a series of secondary rigoles, known as *rigoles of repartition* at intervals of about 50 metres, originate in the primary rigole, and are directed straight down the side of the hill. The bottom of these derivatives is made about an inch higher than that of the primary rigole which can thus aliment several of them at a time. From the secondary rigoles of repartition, smaller rigoles of diversement branch out on both sides. The latter are traced almost perfectly horizontal, they are about 5 metres from each other. Fig. II. shows a portion of a meadow laid down in the way described above. Where the rigoles of repartition originate from the primary rigole, small vannes or sluices are placed, the communication, however, between the former and the rigoles of diversement is free, a small piece of plank, or stone, or brick serving the purpose of a sluice at the time of irrigation. To begin with, the irrigator opens as many vannes as the primary rigole can feed at the sametime, he next arrests the downward flow of water by placing pieces of stone, etc. across the descending rigloes immediately below the first pairs of embranchments, the water is thus diverted into the latter, and soon begins to diverse itself by their inferior border. When the first strip has been thus watered, the irrigator replaces stones at the second embranchments, which done, at the third ones and so on to the bottom of the meadow. It will be observed that any pair of the little rigoles of diversement serves as well as rigoles of evacuation for the pair immediately above it. When watering with a continuous current is desired as in winter, water being then very plentiful, the passages at the embranchments are half closed, so that the lower portion of the fields may still get some virgin water.

When the slope of a meadow is greater, the system indicated above is no longer applicable, as water would then flow with excessive rapidity in the descending rigoles, and thus it would be extremely difficult to divide it regularly in the horizontal rigoles of diversement On such lands the system of irrigation is very simple, as will be seen in Fig V. When water has to be carried over long distances (say) over 50 metres and more, the primary rigole is hardly used for diversement as the flow of water is then too strong to allow of an uniform overflowing. In the latter case it gives rise to smaller rigoles which serve for diversement, as shown in Fig. V. For shorter distances, the primary rigole can serve as well for diversement. It is evident that with very broad meadows, it would take a long time for

the water to flow down the entire side; besides in thus flowing, it would lose all its manurial value before it would reach the lower levels. Moreover, where the soil is very light, and water is scarce, it is impossible to water the whole meadow by a single diversement. To avoid these difficulties parallel horizontal rigoles are traced at intervals depending on the slope and nature of the ground (generally from 10 to 15 inches). Each of these rigoles is fed either independently from the reservoir, or by the primary rigole at the top. They are quasi-horizontal, unless they serve as well to carry water to other parts, when a feeble slope is given to them. On the school farm at Lezerdeau there are two large reservoirs and 4 or 5 smaller ones. Irrigation begins with October, and is continued all winter and spring within the second or third week before mowing. In winter the reservoirs are usually full and waterings follow each other as closely as possible. In spring they are given at intervals, the period of watering graduallly shortening as water gets scarce and grass becomes ripe for mowing. Irrigation is stopped during the entire mowing season; a few waterings are given in summer between the mowings and pasturing but then they are too limited as water falls short in this season.

The superior effects of irrigation are eminently striking at Lezerdeau although the climate is very humid. The meadows afford two heavy mowings in the season and a subsequent autumn pasturage. Of the various beneficial results obtained on the farm it is none the less important to observe that irrigation has supplied one of the best means to get rid of ferns and other noxious weeds, as these can not stand long waterings and soon give way to useful plants which then push up vigorously.

AGRICULTURE OF FINISTERE.

The Agriculture of Finistere in common with that of many other parts of Brittany, has been largely influenced by various circumstances, social and physical, of which it is necessary to recount a few important ones. Originally descended from the Teuton race, the Britons have so long kept the purity of their blood, of the language and manners of their ancestors. Their physiognomy is at once distinguished from that of the Latin race to which the rest of the French belong. An entirely distinct language, and an almost perfect seclusion in the highlands of Brittany have kept them more or less away from the general current of progress in France; even at this day, in spite of the equalizing tendencies of the age, they are regarded by competent observers as at least a century behind in the march of modern civilization. The true Briton house with its curved roof heavily thatched with straw is still pretty common in the interior, heavy cubical bedsteads with folding doors present a singular relic of olden times. The people are conservatives of the most orthodox type, alike in religion and politics as in agriculture, they are very slow to change. The clergy wield an enormous power in Brittany, the revolution of 93 scarcely affected its pious children. The recent annulment of the senatorial election of Finistere has been a violent rebuff to the Briton clergy who had been hitherto manipulating all the political powers of their faithful flock. So long secluded from the general current, the country is at the present time undergoing a series of far reaching revolutions. It is hardly sixteen years that Railways have been extended into the extreme west of France, and already remarkable changes have taken place in the habits of life in the people. Side by side, compulsory service in the army and compulsory education a measure of only recent years, will influence in the same direction. Before railways were introduced the peasant lived an almost totally vegetariam life, tasting meat perhaps once or twice a year on days of high festivity. Their sole ration consisted of and to a large extent even now consists of, black bread and a peculiar *crepe* or pan-ack made of buckwheat flour. Many peasants do not know how to read or write, not to say that they neither speak nor understand the French language. In a few years, however, a new generation will rise, who shall have no such difficulties, all the evils of circumscription and seclusion will thus steadily disappear. The price of labor has risen a good deal in these latter days; with all that, however, it is 15d for man, 10d for woman per day—scarcely half of what a laborer earns in other parts of France.

I have already sketched the leading physical features of Finistere. It remains for me now to say a few words on the way in which some of them bear on the agricultural enterprise of small peasants. In walking through any part of Finistere, one meets with cultivated fields as often as with broad expanses of heath. All high altitudes along the eastern border of the department, the tops and sides of hills are alike but vast sheets of heather, broom and fern. These are occasionally relieved by small patches of meadow, or fields where buckwheat or rye may be struggling with ferns which are the natural heirs of the soil of the district. A totally different order of things is visible along the sea-coast. There a very superior nature of cultivation prevails; along the sea coast I have seen some of the most splendid crops of wheat and oats that I recollect to have

seen in France or elsewhere. The peasants seem to be in much easier circumstances; they have no longer to contend for the mastery of their fields with ferns so inexorable in other parts. They use large quantities of sea-weeds to manure the fields, these decompose rapidly, and when duly mixed with home-made manure, do not fail to yield abundant harvests. Between the sea coast and the eastern border of Finistere, is the region of middle altitudes from 300 to 400 feet above the sea. This includes Lezerdean. The order of things here is midway between what it is in the districts described above. While extensive fields and meadows are quite common, there remains a good deal of waste yet to be reclaimed from the wild state.

It may be now asked what prevents the reclamation of such lands? To this it may be simply replied that the difficulties are so immense that a good deal even of such as have been already reclaimed is far from being so in the real sense of the term. I have previously stated that according to chemical analysis some soils in the neighbourhood of Lezerdean show an amount of acidity which is stupifying. Acidity of soil is always fatal to the growth of crops; it must be neutralized in any case before successful cultivation may be at all possible. To destroy the acidity of the soil, we have two means. The first consists in employing and incorporating with the soil such a quantity of lime either as carbonate or phosphate as corresponds to the degree of acidity. On the soils above mentioned fully 50 tons of carbonate of lime would be required to attain this end, which means a prodigious expense of no less than £20 per acre. Such a measure is clearly outside the means of even the richest proprietor. The second means consists in helping the oxidizing action of the air by frequent deep stirrings of the soil, as well as such means as weeding, draining, etc. In either way capital lies at the root of the question: the problem of reclaiming or amelioration of poisoned soils revolves itself into one of capital. The question of capital presents two important aspects in relation to the *petite culture* of France. In the first place it passes for an axiom that the amount of relative capital, that is, capital sunk per acre of soil cultivated, is much more considerable in case of small properties than in that of larger ones, to be equally effective in either case. Thus while a farm of 100 acres can be well cultivated (say) with a capital of £10 per acre, it is next to impossible to cultivate in the same way one of 20 acre, even with a capital of £20 per acre. Capital is much less effective in small properties, simply because it does not find its full sphere of action.

In the second place, the French peasant, even supposing him to have sufficient capital at hand, instinctively prefers to sink it in the purchase of land, rather than to employ it in ameliorating what he already has. This great evil—the demon of property of French economists, undermines the very foundation of all agricultural improvements. While capital is minimized for the cultivation of the soil, it is pushed to its maximum in its purchase; land not worth 25s. an acre elsewhere often sells for 5 000 francs a hectare *i. e.* at a fully 60 years' purchase; such sales are only possible in small parcels, in order to be within the reach of the largest number of competitors for the purchase; large properties are thus disposed of in this way with great benefit to their owners; a practice which still further aggravates the evils of land dissection as it has been termed. This intense thirst of the French peasant for increasing and rounding the corners of his little property results from the social constitution which has risen out of the French law of heritage. All property being equally divided among the children, it is quite natural that the peasant, whose occupation is at any time too small, should be anxious to augment it, so that he may leave enough to every child on his death.

To return to Brittany. Although expensive culture is all but unknown among the small proprietors, yet here and there, cases are found in which the cultivators have made some attempts towards it, and obtained good results too to boot. One instance of this kind is found in the person of a very enthusiastic peasant named Pilorger, in the vicinity of Quineperte. I went to see his property one day in company of Monsieur Viaud, Professor of Agriculture at Lezerdean. It consists of about 30 acres, a great portion of which the owner has reclaimed for himself, from ferns and heathers at considerable expense. Monsieur Pilorger enjoys a well merited reputation in his district for his potatoes. After having experimented with 50 different varieties of potatoes he has arrived now to choose three or four which give him the best results. One of these, it may be mentioned, is the *Magnum Bonum*, so favourably known in England. His pastures and fields are heavily manured every second year with farm-yard-manure which he enriches with night-soil obtained at Quineperte; their produce is far superior to the average of the country. It may be stated by the way that night-soil is pretty frequently used in Finistere, as well as in many other parts of France, but its use is by no means general. Apart from the prejudice against it, it requires a good deal of special tools and carriages, etc. in order to its utilization. Monsieur Pilorger is also a good breeder of the native Breton cattle; recently a herd book has been established of the breed; several of his cows has been entered in the book, and a bull and a cow of

of his house attained the first prizes in the last Regional Show at Brest. Though a peasant, he is well instructed, reads the important agricultural journals and thus closely follows the precepts of modern agriculture, and no doubt to these he owes his success.

The condition of the smaller class of peasants is anything but enviable. The average size of occupations is barely 3 hectares (7 acres). These with soil so handicapped by nature as described before offer at least a very meagre subsistence. All the evils of land division have been exaggerated in Finistere. Elsewhere industry and emigration carry away the surplus of the peasant population, and thus prevent to some extent excessive pulverization of land. That land has been more minutely divided in Finistere than in many other parts of France is at once evident in the relative size of fields. These are often ridiculously small in Finistere, on one field hardly half an acre in extent I counted four distinct crops growing side by side, *viz*, buckwheat, oats, potatoes and clover. The size of the entire property of the owner may be easily imagined. The ignorance of the Breton peasant prevents him from going far in quest of more remunerative employments. When he has not sufficient land to occupy all his time, he has to rest content with 12*d*. or 15*d*. of wages, which he can earn by day work. Rather cleanly in appearance, his dwelling, however, often presents the most filthy appearance. Pigs and poultry may be seen grazing alike in the yard as inside the house; all the filth and muck of the manure heap outside being drawn, so to speak, to the very foot of the bedstead. His destitution is often painful to behold. From what I have seen since then in the south of France, my ideas as to the relative easiness of peasant life have almost entirely changed. In the south, as I shall have occasion to speak of in later reports, the dwellings of the peasants, and the amount of comforts inside them leave nothing to be desired. In Brittany, the state of the peasants is often very disappointing. Beggars abound everywhere. From the railway station to the town of Quineperte, within a distance of a mile, one can surely count upon meeting at least half a dozen of semi-starved creatures. In fact, the prophecy of Mac Culloch has been so far verified in the case of Brittany, when in the year 1823 he wrote "in half-a-century France will have become the great pauper-warren of Europe." Happily, we have reason to believe quite otherwise in regard to the other parts of France. Begging, however justifiable it may be in particular cases, is always liable to carry in its train results of a demoralizing nature; it has not failed to do so in Finistere. Very often boys and girls are made to beg, though apparently in easy circumstances, and often stout robust fellows would not hesitate to stop beside on the road to beg for a penny. I was deeply affected with the extraordinary amount of beggary I saw in Finistere, but have been greatly relieved to see a happier order of things in the south.

The peasants of Finistere have profited very little by modern inventions and the teachings of scientific agriculturists. In rare cases the old heavy wooden beamed plough has been abandoned for modern ploughs; primitive butter-churn which consists of a wooden or earthen-ware jug filled with a vertical piston and a horizontal disc is still pretty common in these extreme western parts of France. With few variations, the husbandry is still the same, as it long has been. In the conservation of manure, the peasants show singular ignorance of details. They have long learnt the use of lime by experience; happily for them vast accumulations of calcareous sand occur along the coast of Finistere; it is composed of the comminuted debirs of marine shells &c. and contains generally from 45 to 60 per cent, and often as high as 80 per cent of carbonate of lime. The expenses of carriage are heavy when it has to be carried long distances. At Quineperte which is about 7 miles from the sea it sells for about 4*d*. a cwt. The use of phosphatic manures is one of the lessons the peasants of Finistere have learnt from the teachings of agriculturists. The soil being usually acid, the neutral tricalcic phosphate is invariably preferred to the acid superphosphate of lime.

A few words should be said on the live stock of the district. Brittany enjoys a very wide reputation for its cattle and horses. The Breton cow is indeed remarkable in many points. A veritable liliputian, she nourishes on very small quantities of food, often of a very inferior quality; with this she yields milk which is alike extraordinary in quantity and quality. On an average, she gives 260 gallons *per annum*, fully half of the yield of average shorthorn cows, though she is hardly a quarter the size of the latter. While on the other hand, her milk yields 25 per cent of cream, which is astonishing when we see that the richest milk of the Jersey scarcely gives 20 per cent. She is very sure of foot, and thus well adapted to grazing on steep hill sides. Her condition in Finistere can be, however, hardly envied. She suffers in common with the general agriculture of the district. The poorer peasants have not food enough to maintain their beasts. They are very often tethered on road sides, or on margins of corn fields where they pick up, as best they can, any grass that may straggle among the ferns. It is marvellous how

they live on such a scanty fare ; but it is not the less certain that their stunted form is only the result of insufficient nourishment. With better nourishment, they do not fail to increase in size, as is very evident in the little herd of Monsieur Pilorger whom I have named before. At Quineperte there is a very large market of cattle which meets every Friday; an enormous number of cows is here sold off for exportation to different parts of France. A great deal of shorthorn blood has been lately imported into the breed ; with shorthorn cross, the cows attain much larger size and yield more milk, though the latter deteriorates a little in quality. A few years ago Ayrshire bulls were in great demand for crossing but the results having been very disappointing, the practice has been entirely abandoned.

The Breton horse enjoys perhaps a wide reputation than the cow. It is largely sought for from all parts of the country. Rather light in form, it is admirably adapted for all farm work, while often it trots well at the cart.

Brittany has a peculiar breed of white pigs of about the size of middle Yorkshires. It has never been improved ; the enormously long heavy head, high legs, and large flapping ears of the Breton pig show it to be rather akin to the wild pigs which graze on the shores of the Highlands of Scotland. Brittany has very fine sheep, a black breed is sometimes met with, these live by browsing among heather at high altitudes.

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BENGAL FOREST ADMINISTRATION.

The Conservator's Progress Report for 1884-85 was not only submitted considerably after the prescribed date fixed for the purpose, but its consideration had to be postponed by Government owing to the pressure of work in connection with the floods in Bengal. The Lieutenant-Governor characterises the Report as "full to a degree," but animadverts on its unnecessary length. His Honor takes this opportunity to pronounce against long departmental reports. Brevity and lucidity are hereafter to be the essential feature of such narratives, but these advantages are not to be gained at the sacrifice of such information as is considered material for Government to receive in the interests of the Administration.

We learn from the Resolution that the total area of the various classes of forests under Departmental control in the Province is rather more than seven and a half million acres, over three millions of which is "reserved," and nearly a million and a half "protected." These figures do not include the large extent of private forest in Bengal outside State supervision ; and the Lieutenant-Governor expresses the hope that "some simple rules of conservancy for the protection of these valuable properties" may be soon formulated by the Government of India, from which "very great benefit would undoubtedly accrue to the owners" concerned, "as well as to the country generally." It would appear "that with slight exceptions all the boundaries of the forests under the management of the Department were cleared, and the boundary marks repaired where necessary during the year." The important work of forest demarcation and survey is progressing satisfactorily. It is interesting to learn that the *modus operandi* adopted by the Department in this matter is by "working plans, that is, definite schemes of working to be adhered to over long periods of time." These working plans, the Conservator asserts, are based upon the results of experiments in a selected area of forest, from which "the factors of conversion and other data necessary for the correct estimation of growing stock" are obtained. But the Lieutenant-Governor observes that "this statement needs explanation." We think so too.

In regard to *Conservancy* proper, we find that efficiency in the lower subordinate staff of the Forest establishment is apparently secured by the criminal prosecution of its members. Better supervision generally has resulted in fewer breaches of Forest Laws. We regret to learn, however, that notwithstanding special measures, protection from fires has been to some extent a failure. The Lieutenant-Governor insists on the adoption of additional precautions by the Conservator to prevent like disasters in the future, and he, therefore, "desires that in the next budget a more liberal allowance be provided" for fire protection. The conservator with naive simplicity complains that "it is very difficult to bring the Kols to understand that they must not light fires indiscriminately in reserved forests." The revenue from grazing is comparatively small, though including the sales of grass and leaves for fodder. The number of cattle admitted into the forests is barely 25,000. In respect to proposed and suggested regulations on this head, the Lieutenant-Governor correctly declares that the question of cattle grazing in forest tracts is not one which can be decided with reference to considerations of forest conservancy alone." The matter of village fuel-reserves has escaped attention in the Report. His Honor says "Much has been written regarding it but nothing practical has yet been attempted. In

the items of "Natural Reproduction," "Plantation" and "Cultural operations," good work is being done by the Department. It is interesting to learn that the "experiment of opening out the soil in the Buxa Reserve by driving elephants through the forests with light logs attached to them has been a success, and when this has been done, followed by broad-cast sowing of sal seed to assist natural reproduction, seedlings have come up plentifully." There are 3000 acres under plantation or other cultural operations. This area is planted with a variety of useful trees, which at maturity will amply repay all the expense that has been incurred in their preservation and development. In the Buxa Reserve, it will surprise many to learn that the seedlings of *divi divi (Cæsalpina coriaria)* were devastated during the year under review by field-rats, which destroyed all but a small number of plants in a block of 45 acres.

The yield of the Forests is classified under the heads timber, fuel, bamboos, and minor produce, the removal of which is effected for the most part by private agency. There was a falling off in all the operations embraced under these heads except under the head "bamboos," where there is a slight increase, as compared with 1883-84. This decrease in the working of the forests is variously accounted for. In one instance it is due to changes in the permit system, while in another it is ascribed to the large clearings made for tea cultivation, the demand being in great part met therefrom. The accumulation of stock from previous years is likewise an important factor in connection with the present diminished out-turn. We are therefore prepared to learn that as regards the Financial results, the expenditure of the year "was higher than it has been in any previous year; while the receipts were less than in any of the preceding three years." The paragraphs of the Government Resolution are relieved by one of extraneous matter of more than ordinary general interest which will bear reproduction without mutation

The important part played by *Fakirs* in the working of the Sunderbun forests deserves a word of passing notice. They accompany parties of wood-cutters in those forests to protect them by their religious observances from tigers. Notwithstanding the presence of these *Fakirs*, it is reported that tigers made great havoc among the wood-cutters during the year, killing no less than 116 men. Among those killed were two *Fakirs* in charge of *Parahs* or wood-cutters' Stations. "Several *Parahs* were abandoned, because of the number of men carried away from them by tigers, and in one case 17 wood-cutters were carried away from a single *Parah* on the Bhudder river, before the remainder lost faith in the *Fakir* in charge."

Despite negative results financially, there has been substantial progress in the administration of the forests of Bengal during the year 1884-85. The future, says the Lieutenant-Governor, is not to be discounted at the expense of annual surpluses which are better directed in increasing permanent resources and therefore His Honor is not only pleased to record his satisfaction on the operations of the Department, but "to repeat the commendation expressed on previous occasions of the Conservator's zealous and efficient management."

ENSILAGE.

The question of storing fodder is intimately connected with the improvement of cattle in India. Paddy and wheat straw are the only two dry fodders that are at present almost universally used for feeding cattle. Hay-making is almost unknown in Bengal, while in other parts of India as Bombay it is restricted to a very limited area. Generally speaking paddy and wheat straw are the only two fodders which the cultivators and cattle-owners fall back upon in summer and rainy seasons when green fodder becomes either scarce or not easily accessible. In fact straw occupies the same place in the rural economy of India as hay in Europe. The dependence of cultivators on straw alone as their principal fodder places them at a great disadvantage during years of drought in which along with the failure of grain crops their fodder also fails and which therefore are fatal alike to men and cattle. The invariable breaking out of cattle plagues in some part of India or other during summer and rains is mainly owing to scarcity of fodder in those seasons and it is a well known fact that weakned condition of health brought on by insufficient food predisposes animals to attacks of plague and other diseases. The system of storing green fodder in pits or silos with a view to have fodder reserve during seasons of scarcity is on its trial in India and if found practicable and acceptable to the cultivators in general, will be the solution of a great difficulty in the intricate problem of agricultural improvement in this country.

With a view to find out how far green fodder can be stored in pits or silos, Brigadier General H. C. Wilkinson of Calcutta conducted a series of very valuable experiments in 1884-85 to supplement those of the previous year. Trials were given to three

kinds of silos:— (1) masonry silo, (2) pit silo and (3) stack silo and to three different kinds of loading:— (1) quick-loading, (2) slow-loading and (3) loading for sweet silage.

We are at one with General Wilkinson in thinking that it is absolutely necessary that the walls of masonry pits should be perfectly perpendicular and that the corners should be well rounded off. General Macpherson of Cawnpore who advocates sloping walls in masonry pits will perhaps be convinced of his error by the fact that the forage about the middle of a silo constructed by General Wilkinson with sloping walls inorder to test the Cawnpore plan, was doubled up in layers, in folds of about 4", in width throughout. This disrupted the whole bulk of the silage and probably admitted a certain amount of air. The three systems of loading which were tried in masonry silos will be better described in the words of the General himself.

(1).—*The Quick Loading System.*

As rapidly as possible, the work being completed in one day.

The supposed advantage of this system is that very little fermentation takes place; the forage remains little changed in weight or bulk, only the first stage of fermentation having been reached.

The disadvantages are that, however firmly pressed down and trodden, the green forage at first occupies from ¼ to ⅓ more space than it does a week later, when fermentation has died out, so that from ¼ to ⅓ of the silo space available eventually remains unoccupied.

(2).—*Slow Loading System.*

By which a silo is filled gradually, as is most convenient, the time occupied being a week, ten days, or more.

By this system, as the grass is not covered over till the silo is filled, but is only trampled down as firmly as possible daily, fermentation acts in at once and progresses slowly until the work is completed.

The advantages claimed for this system are that it is much more convenient, especially for small farmers; that the action of fermentation causes the grass to settle and pack much more closely than it otherwise would, thus enabling the silo to be filled slowly to the very top, after which little settlement takes place.

That the grass, though much more fermented, is still in a state that many believe to be the very best for feeding and fattening purposes.

On the other hand, some think that during this process of fermention the forage loses an appreciable amount of its actual bulk and weight.

(3).—*Sweet Silage.*

The third process is that by which "sweet silage" is made.

A little partly-made sweet hay is put in the bottom of the silo (to act as yeast does in bread-making); green forage is then lightly loaded in on the top of the partly made hay to the depth of about a yard; this is *not* pressed down or trampled, so that strong fermentation sets in at once. As soon as a temperature of 122° Fahrenheit is reached, the forage is firmly trampled down, the "bacteria" of sour fermentation having been destroyed by this heat. More green forage is now added to the depth of another yard, and the process is continued as before till the silo is quite full, when it is covered over like any other silo.

If every portion of the contents has been duly heated to a temperature of 122°, the result will be silage as sweet as good old hay.

The advantages of this system are that the very strong and disagreeable smell of sour silage is avoided, and that the silo (as in the slow loading system) can be filled to the very top.

The disadvantages are that it takes much more time and trouble; that the green grass must not be very wet with rain; and that when the silo is once opened the contents must be rapidly consumed, as "sweet silage" *will not keep.*

Of the three systems of loading the one that is likely to be generally adopted by the Indian cultivator is the slow one. Supposing the grass to be available, the ryot will never be able to cut it all in one day and stack it at the same time. If he ever adopts the practice he will go on cutting the grass and filling it in silos leisurely. This plan will recommend itself to him the more, because this will enable him according to the showing of the General to pack more material within a given space than possible in any other system. The system of loading for making sweet silage is too intricate to be ever adopted by Indian cultivators as remarked by Mr. Allen in his article on ensilage in the June number of the Agricultural Gazette. The masonry silo was filled according to the slow system. 192¼ maunds of "ulu" (Imperata arundinacea) were packed within it. The process of packing began on the 4th and ended on the 10th October 1884, thus taking 6 days in all. On this was placed a layer of clay 4" deep and well rammed

so that the grass subsided and the top of the clay stood at the height 5ft. 6 inches. As there was plenty of space still left in the silo, a further re-loading was commenced on the 10th, and by the 15th another 192¼ maunds were packed in it over the first and covered with mats and a layer of earth 1 foot 7 inches thick. The grass in the upper and lower part now subsided so much that the top layer of the earth stood at the 9-foot-line. On the 6th of November the mass sank to the 8-foot-mark, since then it ceased to sink. It will be seen that the total depth of the slowly-loaded silo was 8 feet, 1 foot 11 inches of which consisted of well rammed earth. The whole of the silage therefore amounting to 384 maunds, and 40lbs was compressed into a space measuring 10 ft. long by 10 ft. broad by 6ft. 1 inch deep. On weighing the silage produced carefully it was found that the green grass lost about 28 per cent in weight in the process of conversion into silage. As it is very desirable that farmers and others should be able to form a fairly correct estimate of the amount of keep that they will obtain from a silo freshly filled on the slow-loading system, General Wilkinson gives a practical hint. He says that knowing the cubical capacity of his silo and the depth occupied by the grass when well trodden down before any weight is placed, the farmer may count upon obtaining about two-thirds of that depth of matured silage. Silage weighs from 35lbs. to 40lbs. to the cubic foot and one cubic foot is a full allowance for a large Hansi or English cow. Exactly one half of this is sufficient for one of the very small village country cows or an ordinary agricultural bullock. So that a masonry silo 10×10×10 containing, say, 6 feet of good sound silage will feed an English cow (10×10×6) 600 days, or a pair of country bullocks for the same period.

To elucidate the principle whether green fodder can be safely stored in India, the above experiments with masonry silos are invaluable; but to make the system acceptable to the ryots, a detailed description of the results of the pit-silos would have been of more practical bearing, the omission of which is much to be regretted.

We take exception to two facts mentioned in the report. In the first place, we are not prepared to accept so general an assertion on silage that "the older it is the better it is" and in the second place that "silage has been proved by experiment to be more fatting and nourishing than green grass and that cows fed upon silage give more milk and their milk yields more cream than when they are fed upon grass." We need not repeat here the remarks already made by Mr. Allen while discussing the subject in the second number of this Journal to prove the defect of General Wilkinson's experiment on the feeding value of green grass and silage and the fallacy of the arguments based thereupon. We must add that the forage in most of the silos was found to be an excellent sample of ordinary wet sour silage uniformly good throughout. The waste was limited to 2 inches of grass immediately under the mats. The forage in contact with the wall was also slightly mouldy.

In the Appendix D attached to the report is an analysis by Dr. David Waldie of a sample of hay and a sample of silage, both made from the grass of the ditch of Fort-William. As this is one of the very few analyses we have come across of grass (hay) and silage made therefrom, it will not be out of place to quote it here at length, compare it with a similar analysis by Prof. Kinch taken from the April and May numbers of the Journal of the Chemical Society for 1884, and glance at some of the conclusions deducible from them.

	Hay dried powdered	•Ensilage dried & powdered	Hay	Silage
Water expelled at 217° F.	6·52	5·20	...	
Fatty matter	2·90	8·00	5·55	7·
† Albuminoids	5·51	5·32	9·32	9·44
Fibre	28·50	27·80	28·82	31·89
Ash	11·08	16·60	8·50	10·10
Acid fixed and volatile calculated as acetic acid	0·69	0·12	...	...
‡ Soluble carbohydrates including sugar, resinous and pectous substances &c.	45·32	41·96	47·81	41·45
§ Albuminoids by Phenol method	...	...	8·46	4·25
Percentage of total Nitrogen which is non-albuminoid by the same method	...	...	9·20	54·90
	By Dr. Waldie.		*By Prof. Kinch*	

• To make the figures accurately comparable, the percentage should have been given on powdered hay and ensilage dried at 212° F., as given in the table of analysis by Prof Kinch. As it is enough foro ur purpose

† This is the usual method of calculating the albuminoids, by finding out the total nitrogen and multiplying that by 6.25.

‡ In Dr. Waldie's table this is given under four different heads which for convenience of comparison we have added together and reduced under one head

§ Represent true albuminoids

Although the grasses and silages of which analyses are given in the two tables quoted above are quite different, they are singularly alike in so far as they tend towards the same conclusion. It will be observed that the percentage of fatty matter has been increased in the silage in both, though not in the same proportion; the amount of soluble carbohydrates has decreased (through fermentation) and the quantity of ash increased in both but very considerably in Dr. Waldie's sample. Judging from the amount of ash, there has been a considerable loss (18 per cent in Prof Kinch's specimen) of combustible constituents (organic matter). This is further borne out by the fact that soluble carbohydrates have decreased considerably in both, more than what can be accounted for by the increase in the per centage of fat or fibre in Prof. Kinch's specimen and of fat alone in Dr. Waldie's sample. In the latter fibre also has slightly decreased. Even if we accept Dr. Waldie's assertion that "the large quantity of mineral ash in the silage is apparently due to "adhering mud," still his analysis leaves no doubt whatsoever that the ash had increased even if that source of error, *viz.* adhering mud, be eliminated. Then again in Dr. Waldie's analysis, the total nitrogen in the grain and silage has been, as is still common, calculated as albuminoid but it has now been found out "that grass and other fodder crops, like most crude vegetable products, contain nitrogenous matter other than albuminoids and that the amount of these depends largely on the relative stage of development of the plant, the less mature plants containing a larger percentage of non-albuminoid nitrogen. What may be the exact nutritive value of these non-albuminoid nitrogenous bodies is as yet unknown, but it is certain that these can replace true albuminoids in food to a limited extent only." (Journal of the Chemical Society, May 1884, Pages 122, 123.). Dr. Waldie's analysis does not differentiate the nitrogenous bodies of grass and silage into true albuminoids and pseudo or non-albuminoids, but from Prof. Kinch's analyses and similar other analyses it is evident that of the total nitrogen in hay (grass) only a very small (9·2 in Prof. Kinch's sample,) percentage is non-albuminoid while in silage made therefrom, the percentage of non-albuminoid nitrogen is very great (54.9 in Prof. Kinch's analysis.)

Judging, therefore, from a chemical standpoint of view and from all published analysis on the subject which in the absence of any properly conducted feeding experiments the farmers and cattle-owners had better follow, we can not fail to be sceptic about the view taken by General Wlikinson in attaching what seems to us an extraordinary feeding value of silage as compared with the green grass from which it is made.

WHEAT IN BHAGULPORE DISTRICT.

Area under the crop.

In the absence of reliable statistics the area under wheat cannot be accurately ascertained. From rough enquiries a near guess can, however, be made. The area of the district in round number is about 4000 square miles, of which from ⅔ to ¾ is under cultivation. Paddy and *Bhadoi* crops cover a little more than half of the cultivated area and wheat occupies 60 to 75 per cent of the area under *Rabi* crops. Thus 2,700 sbuare miles being the area under cultivation, about 1,500 square miles are under *Rabi* crops. The area under wheat may therefore be roughly estimated at 800 to 900 square miles.

Soil and climate

The climate of the district is certainly not unfavorable to the growth of wheat. If the very finest variety of wheat is not grown here it is not so much owing to the unfavorableness of climate as that of the soil and other circumstances connected with the system of cultivation adopted. There are 3 descriptions of soils on which the crop is almost entirely grown

1st. *Bhita* or highland.

2nd. *Chour* or open spaces subject to annual floods and

3rd *Dearah* land the soil of which is very frequently if not every year rejuvenated, as it were, by a fresh deposit of mud.

The wheat of the *Dearah* is, as a rule, coarse and of inferior quality. The produce is heavy but not quite suited for bread-making. The *Chour* and *Bhita* wheat is of good quality and can certainly be much improved.

The soil of the *Chour* is generally *kewal mittee*. It is very adhesive, and when dry, becomes hard as stone. In consequence of annual flood the soil rots and produces very fine clay. This soil is undoubtedly rich in mineral ingredients of plants. What the *dearah* lands gain from alluvial deposits, the *chour* lands obtain from the decomposition of their own constituents. Thus both of them are in a manner replenished every year.

The *Bhita* land is very different from either of the above. It is either sandy calcareous or clayey or a mixture of two or all of them according as are the original rocks from the disintegration of which it has been formed. In some places transported soils are also noticed and in such cases the soil

is alluvial loam. The *dearah* land is either sandy or clayey. If formed from deposit during first part of the rainy season, it is as a rule clayey and if formed of later deposit sandy. Old *dearahs* are generally good loam.

Varieties of wheat. There are four varieties of of wheat known in the district.

1st Dudhi—It is generally produced on *Bhita* and *Chour* lands. It is rich in starch but deficient in *Sujji* (semolina). The grains are white plump and small sized.

2nd Jamalee.—It gives more *sujji* than the above, but less *maida* (flour). The grains are red in color and longer than Dudhi. It loves moisture and is therefore grown in *dearahs* and other places where artificial irrigation is feasible.

3rd Burghoma—yields more *Sujji* than either of the above but less *maida*. The grains are redder than the last and are also larger in size. The plants too are taller. The ears are blackish and in this respect it chiefly differs from the last. It is supposed to have been introduced from Lahore.

4th Bagra or rather Begra is simply a mixture of the first two. It is produced anywhere and everywhere.

Season. Wheat can be sown in the month of *Kartic* (November) but the best time according to native agriculturists for the operation is *Nuchhutter Sewatee*. It is said that wheat sown later suffers from the westerly wind which prevails about the ripening time and the grains are in consequence shrivelled shrunk and do not mature well. This year the last day of *Sewatee* occurred on the 3rd October. There are 27 *nuchhutters* in a year and therefore each *nuchhutter* is of 13½ days. Thus *Sewatee nuchutter* commenced on the 20th September and ended on the 3rd October and during this period all the wheat should have been in the soil.

Manure and irrigation. As a rule no manure is given to either *dearah* or *Chour* lands. Neither of these require any manuring as the loss caused by cropping is replenished nearly every year either by a fresh deposit of mud or by the decomposition of the soil itself. *Bhita* land alone requires manuring and in some cases does receive some, principally dung which is sometimes supplemented with kitchen refuse and road scrapings. In some places indigo *Sithee* (refuse) is also applied. Dung is applied in two ways. It is either carted and spread over the field in *Bysakh* April and ploughed in as soon as there is a rainfall. Or cattle are rested at night in the field. The latter is done generally on hire system. The cultivators contract with the cow-boy who herds his cattle on the field thus receives which a layer of dung. The cow-boy is paid at the rate of Rs. 2 per bigha. Irrigation is only resorted to in *Bhita* land. Neither *dearah* nor *chour* requires it.

Tillage. The number of ploughings vary greatly with the locality and the nature of the soil. In *chour* land one or two ploughings is all that is given. Sowing time for *Kewal* is very critical. If it is once allowed to get dry all chance of getting a crop from it is gone for that year. As soon as water begins to subside it should be ploughed and following the plough the seed should be dropped.

In *Bhita* the greatest number of ploughing is required, sometimes as many as thirty-two. But this is the case only when no intermediate crop such as *makai* has been taken; for in the latter case 8 ploughings are considered sufficient. In dearahs 10 ploughings are sometimes given and when *makai* crop is taken the land is ploughed 4 or 5 times. With an inverting plough it is believed less number of ploughings will be sufficient.

Sowing. There are 3 systems of sowing known and practised :—

1st. Broad-cast system in which the seed is cast over the field and ploughed in.

2nd. Drill system in which a bamboo tube is attached to the plough and as the plough, proceeds the seed is dropped into the tube and is burried in the rut caused by the bamboo tube.

3rd. Dropping system in which the seed is dropped in the furrow made by a plough the seed being covered by the next furrow. The 2nd system is generally adopted when the soil is rather dry. When the soil is too dry for germination, artificial irrigation must be had recourse to before sowing.

The quantity of seed sown varies with the soil* and the variety of it. In *dearah* land *burgohma* is sown one maund per bigha and *jamalee* 30 seers.

In *Chour* land *doodhi* is sown at the rate of 25 seers per bigha and in *Tikar* or *Bhita* land 30 seers per bigha.

Harvesting. When ripe the crop is cut by sickles and carried to threshing floor where it is allowed to dry for a few days. It is trodden by cattle and winnowed by the simple expedient of exposure to wind, natural or artificial. The thrashed corn is poured from a basket held some 5ft. from the floor.

* A local bigha is measured by a pole of 5½ cubits. A local seer is equal to 101 sicca rupees.

Diseases and injuries — To native agriculturist there are two diseases known *Harda* and *Pilloo* (worm.) I have no doubt there are other diseases too, incidental to this crop but not sufficiently distinct to be discriminated and named by native cultivators. *Harda* is a fungoid disease especially noticed in foggy and moist climate. *Pillo* is a worm which attacks the plant. *Harda* affects wheat in *dearah* or *Tikar* lands, *Pillo* most in *Chour* less in *Tikar* and still less in *dearah*.

Average outturn. — *Chour* and *Tikar* if properly manured give nearly equal produce. Both grow *Doodhi* variety and yeild up to 8 maunds per bigha, 5 maunds however would be a fair average.

In *dearah* the out-turn is greater being 10 or 12 maunds but the average for *Burgohma* and *Jamalee* would be about 10 maunds per bigha.

S. S. Hossein

NEWS

Up to the end of September the area actually under paddy crop in British Burma was 168, 920 acres above last year's area, giving an increase of 5·5 per cent. The increase is common to all districts except Bassein, where there is a decrease of 17,859 acres in consequence of cattle disease and floods. The ploughing and transplanting season was about a fortnight later than last year, but the rainfall plentiful and seasonable and crop prospects were reported to be for the time of year good everywhere, except in parts of the Prome district. No estimate could yet be formed of the outturn, as everything depended on the rice-field getting a moderate but sufficient rainfall throughout October. Up to the 11th October the rainfall of this month in and near Rangoon was decidely favourable for the rice crop

"The area under rice reported in October was 191,936 acres above last year's area, giving an increase of 6·2 per cent. The rainfall was favourable in October in the Lower Districts of the Delta, but in Henzada, Prome and Tharrawaddy the rainfall was not sufficient and a light crop may be expected in these districts, unless they got more rain at an early date. In the other districts the crop prospects were reported to be very good.

" Cotton forecast in Bombay Presidency up to the end of September. *Gujarat,*—Figures for Kathiawar and Baroda not received; area for Broach, Ahmedabad, Surat and Kaira 575,000 acres, as compared with average 550,000 acres. Early rains were favourable, but long break caused withering and damage from insects, good rain has now fallen, and prospects good. *The Deccan.*—figures for Khandesh were not received but estimate 650 000 acres, crop below average in quality; rain late; Poona, Ahmednagar, Sholapur and Nasik, area 25.000 acres as against average 125,000 acres, worse even than last year. Satara return not received. *Southern Maratha Country,*—Returns not received, season very late and sowings not complete, late rain promises excellent prospects. *Sind,*—Returns not received. Incompleteness of returns prevents further remarks.

The second report on the prospects of the cotton in the Bombay Presidency is as follows:—

" *Sind* returns not received. *Gujarat,* British District :—revised area 600 000 acres or 50,000 acres above average; Native States, returns incomplete; prospects improved. *Deccan* (excluding Khandesh), Satara above average 16,000 acres, Nagar, Sholapur Nasik, and Poona much below average, last two far below last year: total area 42,000 acres against average 125,000 acres. *Khandesh*:—662,000 acres or 200 000 acres below last year and 125,000 acres below average: late rains have improved the crop. *Southern Maratha Country*:—sowings late; Dharwar 375,000 acres, Belgaum 125,000 acres, both up to average; Bijapur 150,000 acres, average 275,000 acres; rains deficient. Estimate for Kolhapur and neighbouring State 150,000 acres; young crops healthy."

The Maharaja of Kashmir has published a proclamation abolishing the "rawanagi" duty on shawls. This amounted to no less than 20 per cent *ad valorem* on all shawls sent out of the country, and was in addition to the five rupees local tax on each piece of shawl and a heavy import duty on *pushm*, the raw material brought from Tibet.

A few years ago an attempt was made to grow Liberian coffee at Bangalore; but though the greatest care was taken, the experiment was supposed to have turned out a failure. This season, however, two of the plants are in full bearing, their branches being covered with hundreds of berries. As they appear to be acclimatized, a trial of their seed might be worth making by those interested in coffee. This has succeeded in Burma.

Colonel McLeod is having made, under his supervision, by private labour for the Saidapet Farm authorities, models of the primitive Native oil-mill, plough for sowing seed and weaver's loom, and other appliances as used by the natives of this country. The models will be sent to the forthcoming London Exhibition. Arrangements are being made for the despatch of a selection of Ceylon plants for Ceylon Court of the London Exhibition. Some fine specimens of the sago palm, the date palm, and the tree fern have already been shipped, and other kinds are to follow. On their arrival they will be placed in the hot houses at South Kensington to pass the winter, and from thence, if their vitality has not suffered, they will be transferred to the Exhibition next May.

It is rumoured that a silver mine has been discovered near the boundaries of Bulkanda and Muchra in South Australia. A sample assayed has been shown to yield 694 ounces to the ton.

The artificial fecundation of 80,000 salmon ova is going on at this moment in the aquarium of the Trocadero, France; and when the fry is sufficiently grown to support the change, the French rivers and their affluents are to be stocked with the young fish. The parent salmon, some five hundred in number, were imported from California in 1878. The American fish is, as is known, stationary in its habits, neither requiring nor practising the annual visit to the sea necessary for the development of the salmon of the Old World. The fish have thriven remarkably well in the aquarium, and some of their progeny have already attained a weight of from sixteen to twenty pounds, which is, however, only half the average weight of their full-grown congeners in their native streams. It has been calculated that the stocking of the French rivers with American salmon, if it could be sucessfully accomplished, would represent an annual gain to the country of some forty millions of francs.

The results of experimental cultivation of Guinea grass on the Western Jumna Canal district seem to compare favourably with those obtained in the North-Western Provinces. There the crop was cut about once in the year with an ordinary out-turn of about 350 maunds per acre. At Dadupur the area cultivated was a small one and most of the crop was cut each month to supply fodder to the Government bullocks. The greatest yield was in August and September. The soil in which the grass was grown is sandy and rather poor and will now require some manuring. It seems worth trying whether good fodder can be obtained without recourse being had to irrigation so as to take the place of *bhusa* for bullocks in the cold season. The future of Indian agriculture depends greatly on the growth of fodder independent of grain crops.

The value of Manilla hemp (*Musa textilis*) as a fibre-yielding plant is commonly acknowledged. Shoots of this plant were sometime ago sent from the Saidapet Farm at Madras for experimental growth in the Central Provinces and the Bombay Presidency. They have grown exceedingly well at Raipur, C. P. and endeavours are being made by the Director of the Province to extract the fibre properly but have not as yet met with much success owing to the lack of properimplements. In Bombay the experiments are being tried in various parts of the presidency but as the plant, it would seem, attains maturity in three years, the experiment needs watching for that period. The local Government has also directed that according to the suggestion of Mr. Ozanne, future operations should be confined to the Government experimental Farms at Bhadgaon and Hyderabad, the Botanical Gardens, Poona and the farm attached to the College of Science, Poona.

The rapid growth of the brewing industry in the United States is something wonderful. The value of output has advanced from eighteen million dollars in 1880 to upwards of a hundred millions in 1880. ? It is estimated that over 3,000,000,000 gallonsof malt liquors areannually brewed in the United States and in Europe, of which Great Britain produces nearly 1,000,000,000, Germany 900,000,000, Austria-Hungary 280,000,000 and the United States 600,000,000 gallons.

The Govt Farm at Madura in Madras, has been provided with commodious buildings for the stock to be kept on the farm and several large wells been sunk with good results as regards water supply. The cattle are all kept in confined spaces or boxes standing on the accumulated manure and the results are reported to be most satisfactory. This is a process well calculated in the opinion of the Agricultural Reporter to the Govt to develop the supply of accessible manures which is one of the greatest wants of southern India. This want is equally felt in other parts but the means suggested above of accumulating the manure which no doubt will thus improve both its quantity and quality is ill-adapted to a country in which cattle are mostly reared by grazing in open fields. The practice of making home-manure is very common in France where in walking through miles one hardly comes across a single cow grazing in the open fields. Permanent pastures are not common as in England, the French peasants mostly grow green-crops and adopt the soiling system. The introduction of independent forage crops and the adoption of soiling system must precede any attempt at accumulating manure as suggested above and despite the importance and value of the suggestion, it has very little chance of being ever adopted by the average Indian ryot. Grazing is the mainstay of the ryots' cattle, while independent forage crops and the system of green-soiling are absolutely necessary for the preparation of home-made box-manure. Even in England where the advantages of box-manure is very well known, the practice is very limited, the cattle are mostly graze as long as they can get a bite of grass in the fields and only for a short time housed in winter at a considerably greater expense, to be out again on pastures as soon as the weather permits. The Aden stock sent to the farm by Govt are so far looking well with the exception of two bulls one of which is reported to be sluggish in covering cows and the other unworkable. The Amrat Mahal bull seems to be unable to stand the heat of the plains. Work has also been done in the way of planting trees to surround and shelter the Farm, and of growing guinea grass, vegetables and tobacco, all of which have been found to grow well in the farm.

The Government of Madras insists on such a revision of the curriculum of the Saidapet Agricultural College as will get Mr. Mills the Veterinary Professor, free for six-months in the year for mofussil inspection, although the Principal of the college and the Director of Public Instruction are of opinion that it is impracticable so to arrange matters. The same Government also accepts the proposal of the Director of Agriculture and of the Board of Revenue that the annexe to the Agricultural College should be strictly limited to the area of 40 acres, that the Principal of the College should have no interest in or control over any other part of the farm, and

that his proposal to take up dairy-farming should be at once disallowed. The precise operations to be conducted in the College farm will hereafter be determined in the Education Department. The expression "Experimental Farm" is inaccurate, the annexe being intended for practical demonstration. Mr. Price's idea of opening the reformatory in the Farm for teaching the reformatory boys agriculture and for employing them as gardeners or laborers in the farm has been taken up by the Government. The suggestions and exceptions proposed by Mr. Robertson in this connection have been very summarily dismissed both by the Director and Board of Revenue.

The disposal of the cows, sheep and poultry belonging to the Government Farm Saidapet now abolished will be taken in hand as proposed by the Director of Agriculture. Most of them will be retained to form the nucleus of a breeding establishment to submit a scheme for which the Government has asked the Director. Madras is always ahead of all other provinces in the matter of *Agricultural* reform. Proposals of the Committee, appointed to report on the question whether any buildings at the Saidapet Farm can be made available for the use of a veterinary hospital have been approved by the Government and thanks tendered to the President and Members for the efficient manner in which they have dealt with the matter.

ON THE GROWTH OF WHEAT.

[By J. H. Gilbert.]

The great increase of population which has taken place of late years has, of course, necessitated greatly increased consumption, and the comparison of the home production and the foreign importation for successive periods becomes of much interest. The average annual consumption has increased from a little over 17¾ million bushels during the eight-year period 1853-60 to 24½ millon bushels during the period 1876-84. The average annual home production during the first of these periods was a little over 13 million quarters, and during the last only 8¼ million quarters; on the other hand, the importation for the eight years ending 1860 averaged 4,652,784 quarters, and for the eight years ending 1884 it averaged 15,781,483 quarters.

Over the eight years, 1852-59, only one-fourth of the wheat consumed was obtained from foreign sources, whilst over the eight years, 1875-1883, nearly two-thirds of the entire consumption were imported. It is probable that the home produce will still decline, consequently chiefly on reduction of area under cultivation; whilst with increase of population, imports must increase.

It has been stated that, excluding recent bad seasons, the average yield of wheat per acre of the old arable soils of Great Britain is twenty-eight bushels. Comparing this yield with that of the United States, we find, on the authority of the U. S. Census Bureau, that the general average of localities and years is 11·9 bushels per acre; a yield which is not equal to that of the continuously unmanured plot at Rothamsted, and which is considerably less than half the average yield of Great Britain under ordinary cultivation. This may be partly due to a shorter period of growth, and to rapid maturing, or in some localities to deficiency of rain: but it is probably largely also due to want of sufficient labour to clean the land, and to consequent luxuriance of weeds.

The general averages of the different sections of the States range from 15·1 bushels per acre in New England, to 7·3 bushels per acre in the South Atlantic and Eastern Gulf States. Even the North-west and Minnesota, including much prairie land, give a very meagre average produce for such rich soil. So long as wheat is grown on such lands under the conditions frequent, and indeed almost inevitable, in the case of new settlement—that is, growing it year after year, with deficient cultivation luxuriance of weeds, and the burning of the straw-only low yields per acre can be expected. The result is due to the fact that, under such conditions fertility is cheap and labour dear. But with increased density of population, more mixed agriculture must be adopted. Stock must be kept, the farm kept freer from weeds, the straw used instead of being burnt, and the manure from it, and from the consumed food, returned to the land. Then, and not till then, will the fertility of the rich prairie soils be conserved, and not wasted as is too often the case under the necessities of the first breaking up, and the sparse settlement, of the country. That rich prairie soils can, and should, yield more produce than they do, is clear from the high yields obtained occasionally, under favourable conditions of cultivation.

The average yield of wheat in Manitoba for seven years (1876-1882) is assumed to be twenty-nine bushels. This is however, doubtless too high, even for exclusively virgin prairie soils, under the condition of cultivation incident to new settlement; and the result is probably accounted for by the fact that the records come chiefly from the more intelligent and better farmers. From returns since supplied to me from the Department of Agriculture at Ottawa, the average produce of wheat in Manitoba was, in 1880 20·1 bushels, and in 1882, 24·0 bushels, instead of 26 and 32 bushels as above; whilst the average produce in 1883 is estimated at 21·8 bushels.

All other countries from which trustworthy statistics can be obtained show a lower average yield than that of Great Britain. Unfortunately from only a few countries can very trustworthy estimates be found. These are given below. The recorded yields of Russia and Portugal are very small, and those of Prussia, Bavaria, Austria, Greece, and Egypt are much below the average of the United Kingdom, but these records are too few to justify attempts at accurate averages.

Approximaate average yield of Wheat per acre in different countries.

	Bushels.	
Wurtemburg... ...	25	
Holland......	23	
Belgium	23	
France	16	
Austria...	16	
Hungary	13	
India	14...	Mr. W. W. Hunter's estimate.
United States ...	12	

In connection with this subject of the average yield of wheat of different countries, it is of interest to contrast the condition of soils of very different history, as to their percentage of nitrogen, and so far we are able, of carbon also.

The arable soils of Rothamsted, which have been treated with mineral manure only, contain about ·1 to ·12 per cent. of nitrogen, and about 10 times this amount of carbon in the first nine inches of soil, calculated on the dry sifted soil. A Rothamsted soil laid down to grass in 1879 was found in 1882 to contain ·1235 per cent. of nitrogen; a field down to grass eight years contained ·15 per cent.; one which had been in grass 21 years contained ·2057 per cent. and the very old grass land of the Park contained ·2466 per cent. of nitrogen in the dry surface soil. In these latter cases the ratio of carbon to nitrogen was higher than in arable soil, *viz.*, 12 :1 and 13 :1. Other arable soils of Great Britain usually contain from ·1 to ·22 per cent. of nitrogen in the surface soil. The prairie soils of the United States and Canada show in analyses made by Dr. Voelcker, and at Rothamsted a percentage of nitrogen from ·187 to ·618, and with as high a ratio of carbon to nitrogen as in the grass lands of Rothamsted. Schmidt's analyses of black Russian soils show also a high percentage of nitrogen, *viz.* from ·13 to ·607 per cent.

From these results there are no doubt that a characteristic of a rich virgin soil, or of a pemanent pasture surface-soil is relatively high percentage of nitrogen and of carbon, and a high ratio of carbon to nitrogen. On the other hand, a soil that has long been under arable culture is much poorer in these respects; whilst an arable soil under condition of known agricultural exhaustion shows a very low percentage of nitrogen and of carbon, and a low ratio of carbon to nitrogen.

Finally, it has been maintained by some that a soil is a laboratory, and not a mine. But not only the facts in our own and in other investigations, but the history of agriculture throughout the world, so far as we know it, clearly show that a fertile soil is one which has accumulated within it the residue of ages of previous vegetation, and that it becomes infertile as this residue is exhausted.

What, then, are the probable prospects of wheat-growing in the United Kingdom?

It is seen that on old arable soils, on the average much poorer than those of the chief exporting countries, our produce per acre exceeds that of any other country, and this under a system of tenancy, and of comparatively large holdings, which are said to be the bane of our agriculture. Not only is our average yield higher than that of richer soils, but it is higher than in the chief European countries, where small holdings and peasant proprietors prevail.

Our most serious competitors are those who cultivate, very imperfectly, large areas of rich and frequently, almost virgin soil. In fact, it is area, and cheap fertility, not good cultivation, against which we have chiefly to contend; and with dear labour in the newly settled countries there is considerable waste of fertility.

Our area under the crop has, as has been seen, considerably reduced of late years, and it will probably still further reduce; but to this there will be a limit. At present the disposition is to extend the production of milk and meat, partly by purchased food, but partly by laying down arable land to permanent grass, and partly by growing more cattle food on the arable land. But cattle cannot be largely kept on arable farms without straw; the production of straw means the production of grain; and the question arises whether grain can be profitably grown at anything like present prices?

Sir J. B. Lawes has called attention to the fact that, even at the recent very low price of wheat, the gross return per acre in grain, assuming an average produce of 28 bushes per acre, would be about £6; and barley would yield about the same value. This is exclusive of the value of the straw for feeding purposes or for sale.

Indeed, it seems very doubtful whether arable land can be turned to more profitable account than by still growing a fair proportion of grain, which, considering the value of the straw, is by no means inconsistent with an increase in the amount of live-stock on the farm.—*Agricultural Students' Gazette for August 1885, Cirencester.*

CROP AND WEATHER REPORT.

For the Week Ending the 28th October 1885.

GENERAL REMARKS.—In Madras the weather continues favourable; rain is again reported from all districts, and the standing crops are generally good. The harvest outturn will, however, be below the average in some districts. More or less rain has fallen throughout the Mysore State, where the prospects of the season are now good. Ploughing for vysakh paddy cultivation has commenced. The cattle are in good condition, except in the Malnad district. In Coorg prospects continue favourable.

In Bombay there has been slight rain in the Deccan and Southern Mahratta Country, and more is required for the rabi crops in parts of Nasik, Khandesh, and the Panch Mahals. The Kharif harvest and rabi sowings are in progress in most districts. In the Central India and Rajputana States, no rain fell in the week under report. In the former agricultural prospects are generally fair, but in Rajputana the want of rain has seriously injured the standing crops in many places. Rabi sowings are in general progress. In the Berars rabi sowings continue, but in the Nizam's Territories they have been postponed on account of the rainfall, and fears are entertained of damage to standing crops.

In the Central Provinces prospects are now favourable everywhere, and rabi sowings are in general progress.

Except in the Dehra Ismail Khan District, no rain is reported from the Punjab. The kharif crop is being harvested and rabi operations are in hand throughout the Province. In the North-Western Provinces and Oudh the weather is seasonable but some rain is still needed in a few places for crops on highlands. The kharif outturn is fairly good, and rabi sowings are in active progress.

Rain has been general in Bengal Orissa and Chutian Nagpore, but in Behar slight rain has fallen in a few places only Outside the flooded districts, prospects of amun and other standing crops are generally favourable; sowing of rabi is in full progress, and the crops already sown are doing well. In Assam the weather is seasonable, and prospects are good.

In British Burma crop prospects are good, except in Prome Thayetmy, and where more rain is required.

The general health is fair in all Provinces.

Prices are genouerally steady, except in Mysore and Bengal, where they are falling.

For the Week Ending 4th November 1885.

General Remarks.—Rain continues to fall in the Madras Presidency, where the prospects are now fair. In Beliary and Anantapur the crops have been much improved by the recent rain. Rain has also fallen in the Mysore State, where the standing crops are in good condition and the ragi harvest is in general progress. Murrain is decreasing in the Maland district, and elsewhere the cattle are in good condition.

In the Bombay Presidency slight rain is reported from places in four districts. In Khandesh more rain is urgently required for the rabi crops. Reaping of kharif and sowing rabi crops are in progress generally. No rain is reported from the Berars and Hyderabad. In the former the prospects of the kharif are good and rabi sowings have commenced; but in Hyderabad fears are entertained of damage to the standing crops, and rabi sowings have been postponed for want of rain. In Central India agricultural prospects continue favourable. In Rajputana the crops are suffering in many places for want of rain. Rabi sowings have commenced in a few States.

In the Central Provinces prospects continue favourable, and the kharif harvest and rabi sowings are in progress. In the Punjab the kharif is being harvested and rabi sowings have commenced. Prospects are generally good. Seasonable weather prevails in the North-Western Province, and Oudh, but the crops require more rain on highlands. The kharif harvest has been nearly completed and rabi sowirgs are in general progress.

No rain fell in Bengal during the week under report, and the cold weather is reported to be setting in. Except in flooded tracts, the prospects of the late rice harvest aae generally very good. In some places in Behar the want of rain is still much felt. Rabi cultivation is in active progress, and the crops already sown promise well. In Assam prospects continue good.

In British Burma the crops promise well, except in Prome and Thayetmyo, where the rainfall has been insufficient.

Fever is more or less prevalent in most Provinces; otherwise the public health is fair.

In Bengal the price of rice has fallen in almost all districts; and in Mysore and Coorg prices continue to fall. Elsewhere they are generally steady, except in the Punjab, where they are fluc-tuating, and in Rajputna, where they are rising in some places.

For the Week Ending 11th November 1885.

GENERAL REMARKS.—Good rain has fallen in the Madras Presidency during the last fortnight and agricultural prospects are now good everywhere. In Bellary and Anantapur the condition of the crops continues to be favourable. In Mysore, where there was a fair amount of rain, the prospects of the season are favourable, and the standing crops are in good condition, except that in parts of the Tumkur and Bangalore district more rain would be beneficial. In Coorg prospects continue good.

In the Bombay Presidency there has been rain in several district during the fortnight under report. The reaping of the kharif and the sowing of the rabi crops continue. In the Berars the kharif harvest has commenced and sowings have been resumed in the Nizam's Territories owing to the break in the rains which has been beneficial to the crops. Prospects continue good in the Central India States, and the kharif harvest and rabi sowings are in progress in Rajputana.

In the Central Provinces slight rain fell in two or three districts and prospects continue favourable. Rain is much needed in some places in the Punjab where none has fallen during the fortnight under notice. The kharif harvest is approaching completion and the rabi operations are in progress. Seasonable weather prevails in the North-Western Provinces and Oudh, where rabi operations are still in progress, and have been completed in places. Agricultural prospects are good.

In Bengal the rains have ceased and the cold weather set in. Outside the flooded tracts and parts of Behar the rice crop promises generally an excellent harvest. The cultivation of rabi and boro paddy is proceeding well and the harvesting of the earlier sorts of amun rice has commenced; but in Behar rabi and poppy sowings are backward for want of rain. In Assam agricultural prospects continue good.

Crop prospects are good in British Burma except in the Prome and Thayetmyo districts where there has been a deficiency of rain.

The public health is generally fair.

Prices are fluctuating in the Punjab and the Rajputana, have slightly risen in Coorg, and are falling in Mysore. In Bengal the price of rice has fallen in several district.

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The cultivation of cotton in Assam is interesting in more ways than one. The area under cotton crop in the Province is roughly estimated at 38,815 acres, of which 7,132 acres are in the valleys of the Brahmaputra and the Surma and 31,683 acres in the hill districts. Cotton is very little known in the plains proper of Assam, the growth being principally confined to the hill tracts where it forms a very important article in the annual agricultural outturn. But as elsewhere in India, owing to the absence of any establishment for registering agricultural statistics over the greater part of the province, it is almost impossible to frame an accurate estimate of the area under cotton or any other crop.

*

The varieties of cotton are not numerous. Roughly speaking there are two well marked varieties. (1) The large bolled high growing cotton going under various local names. The pods are very large, sometimes as much as eight inches in length. The fibre is said by the trade to be harsh and to twist badly and is better adapted for mixing with wool than for any other purpose. This variety is not however as much in request for ordinary purposes as the second variety. (2) The small round-bolled species, also variously named in different localities. Its thread can be more closely woven than that of other kinds. This variety is sown annually and can only be plucked once a year. While the variety named above can be plucked twice a year instead of once and bears for those seasons.

The Assamese hill-men grows cotton generally on forest cleanings known locally as *jhums* and prefer bamboo and grass to tree jungle. The soil should be calcareous and the situation sunny. No manure is ever used, except the ashes of burnt jungle. The land is never ploughed for cotton except in the few places where it is grown in the plains. In the latter the ground is ploughed three or four times and then hoed once. But the hill-men always use the hoe, as the slopes on which cotton is grown are too steep to admit of ploughing. The jungle is usually cut in the cold weather and allowed to dry on the ground. It is burnt in March and April and then as a rule hoed. Soon after hoeing cotton is sown broad-cast. In Tipperahs and Garos, after the burning is finished, the seeds are dibbled in with a pointed stick.

Cotton is seldom grown alone by the hill-men. Excepting some varieties as *thumsa* of Cachar, which are always sown singly, the other varieties are as a rule sown mixed with one or more of the following crops :—mustard, Indian corn, chillies, bringals, linseed, jute, water-melon. But rice and til are the crops most usually associated with cotton. Ahu dhan (early rice) is sown broadcast the day after the fire and when the seedlings show themselves above the ground, the vacant spaces become apparent and then are sown with cotton. The reason for associating a second crop with cotton is said to be that the latter always grows best if shaded in the begining. The practice of growing two or more crops at the same

time in the same field is neither peculiar to the crop—cotton, nor to the locality—Assam. Wheat for instance is not uncommonly grown in various parts of India with linseed, safflower, etc. Just at the present season it is a very common sight in the uplands of Bengal to see mustard, barley lentils, and other pulse all growing together in the same field. One crop might help another by affording shelter or support. But it is none the less true that this system of growing associated crops has arisen out of the peculiar circumstances and conditions by which the Indian cultivator is surrounded. When a bad season intervenes, some of his crops might fail, but the others which are hardier might stand the season and this afford him better and safer means of eking out his existence. The practice in Assam of growing one or more crops with cotton has no doubt also this substratum of exigency at its bottom.

A jungle-clearing is rarely cropped for more than one season with cotton. In the second year upland rice is often sown alone, and when the crop has been gathered, the *jhum* is usually abandoned. If there is suitable land available in reasonable quantities, the clearing is not resumed for ten years. In no case is it re-occupied until at least five years have elapsed. No rotation of crops is ever observed. In Cachar in the second year the paddy straw of the previous year is burnt off, and the land having been cleaned and turned over with the "kuar," rice and sesamum mixed are sown broadcast. A few days later Indian-corn and cotton mixed with earth are sown, and the ground is kept weeded till August. The Indian-corn ripens in July, the rice in August, sesamum in November, but the cotton not till December. A similar course is followed in the third year, and in the fourth the land is abandoned. The Angami Nagas, however, frequently crop a clearing with cotton for two or three years, according to the richness of the soil. The variety of *ahu dhan* known as *tidi* is generally sown by them the first year, while in the second year the kind called *teke* is usually planted. The Rengma and Lhota Nagas, who are the principal cultivators of cotton in the Naga Hills, never crop a clearing with cotton for two successive years. Irrigation is hardly ever practised, though occasionally required. The land is usually weeded once or twice, rarely oftener.

When the crop germinates, sacrifices of eggs are offered by the Mikirs to the god Longlo Ahi. Similar ceremonies take place when the plucking begins. Plucking generally begins about November. It is usually over in January. *Kunghideva* is plucked from time to time as the pods open and burst. With *thumsa* the plucking is usually made once for all. The *borkapah* of Nowgong is plucked twice, once in December and January, when the crop is called *bataria capah*, and once in May, when the produce is known as *jetharia capah*. As a general rule, plucking lasts for about a month and a half, and usually an interval of three to six days is allowed to elapse between each picking. Cotton suffers considerably if rain holds off for long after it is put into the ground, as much of the seed does not then germinate. On the other hand, heavy rain when the plant is well grown rots the stems, and, if the pods have formed, injures the cotton within. Cloudy and damp weather is always injurious, except at the very beginning, and for this reason the sunniest spots are invariably chosen. Insects also do a good deal of injury. Whole crops are sometimes destroyed by the *chilapok* of Lakhimpur, the *phalo jingh* of the Nowgong Mikirs, and the *mitchy* of the Naga tribes. White-ants often cause serious loss in the Jaintia and Naga Hills.

The average produce of cleaned cotton per acre is not a very easy thing to make out and varies very widely in different localities. For the whole province an average of 150lbs of clean cotton to the acre may be assumed to be a fairly accurate estimate. This gives an average of 375lbs of raw uncleaned cotton to the acre or a proportion of 2 to 5. The comparison of the outturn of cotton in Assam with that of other provinces is very instructive. It would seem that Assam cotton gave both a larger outturn per acre and also a larger proportion of fibre to seed, than the cotton of most other parts of India. In the Punjab, the average outturn per acre of cleaned cotton is believed to be but 103lbs, and the cleaned fibre is said to weigh only from ¼ to ⅓ the whole contents of the pod. In the North-Western Provinces the outturn per acre has been estimated at 65lbs; but this is stated to be based on report, not experiment, and is believed to be much under the truth. The ratio of cleaned to uncleaned is also taken very low, and is said to be not more than 13 seers to the maund. According to local computation, in Bombay 82lbs of cotton per acre is a 16 anna crop, and in 8884-85 the maximum yield of the American varieties was only 66½lbs. In 1880, however, the highest return reached 170lbs per acre. In the Hyderabad Assigned Districts the average outturn is remarkable, for in the three years preceding 1883, it is taken at 20, 25, and 22lbs per acre, while

the uncleaned cotton is reported to yield no more than one-fourth of its weight of fibre.

The total outturn of clean fibre in the province may be roughly estimated at 51,984 cwt, and the total export at 30,360 cwt. Deducting the latter from the former we have a local consumption of indigenous cotton amounting in last year to 21,624 cwt. Taking Rs. 19 as the average price per maund of clean cotton in the province, we have for the total value of the indigenous cotton consumed Rs. 5,61,165. Adding to this the total value of Indian and European piece-goods, yarn and raw cotton imported, we have Rs. 24,41,319 as the sum which the people of Assam paid last year for their cotton goods. This is Rs. 1-15-3 per head of population. In the Punjab, same calculation gives Rs. 2-12 per head.

The export trade is principally confined to uncleaned cotton. Evidently cleaning with native gin does not pay, and this is stated to be due to the fact that labour is far too dear there and that the seed which has no value there, is saleable in Calcutta where Assam cotton is principally exported. There is a great future for the development of the Trade in Cotton in Assam. The introduction of English gin of which two are already in work in the province and each of which secures a daily net profit of Rs. 5, will, in the opinion of the Director of Agriculture, be a step towards that direction. The ginning machine which work at Tura costs altogether Rs. 420. Here is an open field for the enterprize of our small native capitalists who can recoup themselves for the original cost in burning a ginning machine in about four to five months, provided he can plant his machine judiciously within easy reach of cotton districts.

* * *

We have much pleasure in noticing the demonstrations of the efficient working of improved ploughs mostly of his design and making by Mr. S. Samy Iyengar of the Tinnevelly district, Madras. He visited sixteen places, spent altogether 53 days in holding demonstrations in these places and had the pleasure of addressing or otherwise advising about seven thousand three hundred ryots, landed proprietors and others. Altogether 225 ploughs were demanded. The whole cost of these demonstrations was borne by Mr. Iyengar, whose energy and enterprize deserve thankful recognition by the Government and his countrymen.

Agricultural Education in its various aspects, was the subject of the inaugural address delivered in the University of Edinburgh, on the 28th October last by Professor Robert Wallace, F. C. S., who lately occupied the chair of agriculture in the Royal Agricultural College of Cirencester. The Professor divided his subject into a number of heads of which the following were principal, *viz.* labourer's education, farmer's education, proprietor's education, land-agent's education and agricultural education abroad. Under the first-head, he said "what I emphatically take exception to is the total ignoring of the necessity of any other training than that given by the schoolmaster until a boy or girl is about 13 years of age,—until after the time, in short, as has been shown that ordinary boys cannot, at least in the matter of stock rearing, come up to the same standard of efficiency as their fathers did, who were trained under the old system of education in Scotland. I do not pretend to show, like a legislator what particular course should be adopted as a remedy. I only want to point out to professional legislators that a great social evil is growing in our midst; and that, in so far as the agricultural labourer is concerned, perfect liberty should be given, nay, inducements should be held out, to encourage children to go and take part in all important farm operations at the busy seasons, and, as in olden times, to return to school in slack seasons till a much later period of life than the present minimum regulation. Then a boy begins to see the advantage to him of education, and studies for his own pleasure and benefit."

Speaking of agricultural education abroad, the Professor remarks that "One German State pays a grant of £5000 per annum, or about £73 per student. Others give smaller sums, but all contribute liberally towards agricultural teaching institutions, which are now thought to be indispensable to the public good. France is in no wise behind in her support of and her interest in all the different divisions of higher, intermediate, and lower agricultural education. The smaller countries follow the lead of those greater nations. Denmark, for instance, with less than 2,000 000 of inhabitants, spends £11,000 annually on this praiseworthy object. Great Britain, in short, stands out almost the single exception." If the Professor could blame his Government for being behind hand in the matter of agricultural education in a country which could boast of such institutions as the Royal Agricultural College of Cirencester, the Agricultural College of Downton, the Agricultural chair at the

South Kensington Normal School of Science, a similar chair in the University of Edinburgh, and Rothamsted and Woburn Experimental Farms, and where agriculture is only one of the various industries which can give a decent living to children of the soil, the necessity of such education in India which is exclusively agricultural can be better conceived than described. Mr. Wallace hopes to induce the authorities of the University to institute a degree for agriculture, the examination for which should be equivalent to that of the ordinary B. Sc. and to secure a certain number of youngmen "who had passed by examination into the Indian Civil Service for joining the agricultural classes each year."

The Professor says "Young Civilians are selected under the age of nineteen, and have to remain in this country for two years. Their time could not be more profitably spent than in studying agriculture and the kindred subjects. The Indian Government has of recent years shown that it is most desirous to have a number of men trained in the science and practice of agriculture, and for this purpose has sent over to England, and defrayed the expenses of, a considerable number of Indian scholars, besides giving extension of furlough to various Englishmen in the service, to enable them to finish a course of study in this country. I have not the slightest doubt that, should the University of Edinburgh institute a degree in Agriculture, the Indian Government would readly be induced to extend the period of residence at home from two years to three. This would be all the more easily accomplished in virtue of the fact, that it is pretty widely believed that at the age of twenty-one a man is rather young to go out to the Indian climate. There might, in time, be hardly any limit to the numbers of this class who might present themselves for the degree in Agriculture, as the value of an agricultural training is becoming more and more recognised by Indian authorities, and the development of the agricultural resources of that great empire is only in its infancy, and must of necessity proceed."

The Rev. Mr. Evans, the well known apostle of temperance, has been exposing the Bengal Abkari, in a recent lecture, delivered before an appreciative audience at the Olympus of the Southern Presidency, which is well worth the serious consideration of those having the moral and material interests of India at heart. Mr. Evan's tirade is directed against the present "out-still" system in Bengal, which, from the facilities it affords to the population for indulgence in strong drink, is fast creating a revolution among the lower classes, implying a serious change for the worse. The outcome of cheap liquor everywhere is national intemperance; and, owing to the misguided action of the local Government, it would appear from the excise returns, that things are drifting in this direction at as rapid a rate as possible, towards the ruin of millions in the Lower Provinces. The abolition of the Central or "Sudder" system in 1876-77, led to the establishments of innumerable small stills scattered all over the country, which became actively engaged in forcing their production into localities where *daroo* was practically not known before. The restrictions imposed under the old system as to quantity and quality of the out-turn of the central stills precluded extensive use, and debarred the poorer people from the dubious luxury of alcoholic drink.

The essential difference between the two systems may be briefly explained. The privilege of manufacture under the "Sudder" system was given out on contract, the contractor having to pay a duty on the *Mahua* flower, from which the liquor is distilled, and a duty on each gallon of spirit, not more than 2½ gallons of liquor being allowed from one maund of flowers, th operations being conducted under the surveillance of officials in Government Factories. Under the "Out still" system—manufacture is free in the widest acceptation of the term. There is no restriction or duty. The contractor can make as much liquor as he likes from one still of a capacity for one maund of Mahua ferment, from which he may take not more than 10 gallons of liquor at each draw or relay. These 10 gallons of liquor are mixed and sold, generally with an equal quantity of water, at from 9 pies to 1 anna per bottle, having just about one-eighth the strength of the liquor sold under the old system, at from 12 annas to 1 Rupee per bottle. But, in order that the spirit produced and sold under the new system might give the "desired effect" *viz.*, "intoxication," recourse is had to poisonous materials, which add flavor as well as narcotic power to the drink. The result of this cheap and nasty supply for a wide spread demand may be easily surmised. The "Country Spirit" revenue, in five years from the introduction of the new order of things, has gone up from 26 to 46 lakhs, and bids fair this year to attain about 60 lakhs of rupees. In one division of Bengal, Patna alone, the increase of

revenue from this one article of excise has been in four years nearly 125 per cent. There was ground, therefore, for the outcry against the Administrative, in connection with the Abkari and the resulting commission of enquiry was not appointed a day too soon to check the growing evils.

The returns of the rail borne traffic of Bengal for the quarter ending the 30th June 1885 are published. The total quantity of import during the quarter stood at 5,490,512 mds. against 41,23,196 mds. during the corresponding period of the previous year; and the total quantity of experts at 40,16,171 mds. against 34 21,995. In other words the increse in imports and exports were 33·38 and 17·36 per cent respectively. Under import, wheat, linseed, gram, cotton, rice, lac and ghee showed the largest increase; and mustard seed and poppyseed showed the most marked decrease. Under export the principal items of increase were gunny bags and cloth, tobacco, undrained sugar, and salt, and the principal items of decrease were rice, metals, and European cotton goods. The average wholesale prices for the principal agricultural staples which ruled in Bengal, during the quarter under report were Rs 15-2-3 for cotton, Rs 193 for indigo, Rs 3-2-7 for raw jute, Rs 2-5-9 for wheat, Rs 2-3-4 for pulse, Rs 3-2-11 for husked and Rs 2-2-7 for un husked rice, Rs 3-14-2 for linseed, Rs 3-5-7 for mustard, Rs 3-17-7 for til or gingelly seed, Rs 30 for ghee, Rs 12-10-1 for drained and Rs 8-14-2 for undrained sugar, Rs60 for Indian teas and Rs 7-8-0 for tobacco. Under the head of trade of Bengal with Assam, we see that the import trade during the quarter under review shows a marked increase compared with the corresponding period of the previous year. The river borne traffic carried by country boats, by inland steamers and the steamers of the Eastern Bengal State Railway, all share in the increase.

During the seven months ending 31st October last, the total value of goods including treasure imported into India was Rs 40,00,48,405 as compared with Rs 40,59,58,468 the total for the corresponding period of the previous year. There was a decrease under all heads excepting raw materials and unmanufactured articles which showed an increase of Rs21,15,796 over the corrresponding period of the previous year. The increase under railway plant and rolling stock was Rs 36,19,394 and under living animal a slight increase of Rs 1,75,057. The total amount of exports including treasure during the same period amounted to Rs 45,03,64,145 as compared with Rs 47,47,56,868 in the corresponding period of the previous year. The gross amount of import duty collected including salt was Rs 1,27,10,785 and export duty including salt was Rs 35,18,586.

Mr. F. W. Cabaniss, Assistant Director of Agriculture, British Burma, publishes a note in which it is stated that during the year 1884-85 ghee to the value of Rs. 4,81,161 was improted into Rangoon, most of which however came from India. The selling price of ghee in Rangoon is six annas a pound for the best quality. The price of fresh butter in Rangoon is Rs 1-4-0 a pound and the quality invariably bad. Mr. Cabaniss is of opinion that neither America nor India ought to be able to compete with Burma in the productin of butter or ghee. India has not proportionately as large an amount of pasturage or cattle food, nor has America the low priced labor that can be obtained in Burma for this purpose. One hundred pounds of milk yield from three to four pounds of butter which gives from two and-a-half to three pounds of prepared *ghee*.

One of the chief objections taken to the salt duties is that, owing to the resulting high prices, cattle are stinted in their supply of salt, while manufacturers and agriculturists are required to pay duty on salt employed in industry and agriculture. The attention of the Government of India has been given to the matter for some years in the hope that an unobjectionable method of freeing from duty salt required for the purposes above indicated might sooner or later be discovered. Various experiments were made by district medical officers, scientists and private individuals but none proved successful, the difficulty being to prevent the easy restoration of pure salt from the mixture. The Chemical Examiner to the Government of Bengal and of Panjab are of opinion that under the conditions laid down by the Government of India a solution of the problem can not be expected, and in Madras and Bombay it has been held that the problem is insoluble. The Government of India still hopes that a process may be discovered which if not completely satisfying all the conditions hitherto practised, may yet be sufficient for practical purposes. In this view the Governor-General in Council is prepared to grant a reward not exceeding Rs 5,000 to the inventor or discoverer of a process which will satisfy the main conditions, namely, (*a*) that the cost of the process must be moderate, not exceeding about 4 annas a maund, and (*b*) the

preparation must be such that edible salt can not be easily extracted from it by any of the ordinary processes in use amongst native salt-workers. At the instance of Messrs Burn & Co. of Calcutta, tarred salt is issued to manufacturers of glazed stone-ware free of duty, upon a personal guarantee for its use exclusively in manufacture. This method was adopted and is still practised the salt being issued subject th certain especial rules framed by the Government of Bengal. But tarred salt be it said can only be used for pottery works.

The principal material used in the manufacture of paper in Tonquin is the *ke-yioh* or paper tree, which grows in abundance on the mountains in the environs of Sontay. The dried bark of this is brought in bundles upon the backs of oxen or buffaloes from the mountains, where it is gathered for the numerous paper mills, whose principal centre is in the vicinity of Hanoi. It is worth about 2 cents a pound. This bark is macerated and then rubbed up in mortars, so as to reduce it to a fine pulp. This latter is mixed with a certain quantity of water in order to form a clear paste, which is sized with an infusion made from the shavings of the *gomao*, a tree which grows in abundance on the Black River mountains. The paper is manufactured sheet by sheet by women by means of delicate bamboo screens, that they alternately dip into the paste and take out there-with a thin sheet of paper, which they deposit upon a board. At the end of the day these sheets are put into a press in order to extract the moisture from them, and are then dried by placing them one by one upon a hot masonry wall. Finally they are put up in packages and trimmed. Each woman makes 1,000 sheets a day. The thickness of the paper depends upon the consistency of the paste. The process seems to be very similar to what is adopted by the natives of India in manufacturing hand-made paper.

We have great pleasure in announcing that an Agricultural Show will be held in the District of Shahabad early in March 1886. Last spring a show was held at Dumraon under the patronage of Government on a site provided by the Maharaja. No similar exhibition had been held in Behar, since the Mozafferpore show of 1865. For a first attempt, the Dumraon show was great success. It was largely attended by natives and Europeans, and it aroused a considerable interest among the cultivating classes in agricultural improvement. But the good seed then sown could not be expected to mature unless it were carefully cultivated. Shows held at intervals of twenty years cannot effect any permanent good. The interest once aroused languishes unless it be properly fostered, and the cultivators return to their normal condition of apathetic indifference. Without the stimulus supplied by the hope of gaining prizes, it is idle to hope that any cultivator will trouble himself to improve the breed of his stock or the quality of his seed. It is with great pleasure therefore that we notice that another agricultural show is to be held in Shahabad next year. We see by the date (4th March and four following days) that this show is to be held at the same time as the great annual horse and cattle fair at Barahpur. The Managing Committee are to be congratulated on having determined to hold their show in connection with this Fair, for it will ensure a large attendance of the very persons for whose special benefit such shows are got up. The site which is within two miles of the Raghunathpur Railway Station will enable visitors from a distance to attend the the show with ease and comfort. The Committee with the District Collector as President consists of seven gentlemen whose names appear in our advertisement columns.

Mr. T. L. Jenkins, the Subdivisional Officer of Buxar, whose exertions as Secretary mainly contributed to the success of the Dumraon show has consented to act again in a similar capacity, and the Committee are fortunate in securing the benefit of his lately acquired experience for the present undertaking. This show will resemble its predecessor in many respects but certain alterations in the present scheme meet with our approval. It was quite right that the first show should be held on rather a magnificent scale. This was rendered possible chiefly by the liberality of the Maharaja of Dumraon, but it would not have been right to allow him to contribute again in such a munificent manner. The present show will, very properly, be managed on a more economical scale, but it need not on that account be less useful as a promoter of agricultural improvement.

The number of prizes has been wisely reduced, but the value of a few prizes which are meant to tempt exhibitors from a distance should be high enough to effect that purpose. For instance, nothing is more important, from a cultivator's point of view than good plough-bullocks, and to attract the

best exhibits the committee offers Rs. 50 as a first, and Rs. 25 as a second prize for a pair of bullocks broken to, and used with the plough, not more than 7 nor less than 2½ years of age. Suitable prizes are offered for different kinds of stock, for agricultural implements, for agricultural and horticultural produce. There are also miscellaneous prizes for wool, thread, oil, dairy produce, leather work, and a variety of other articles of native manufacture and art. Altogether over eleven hundred rupees are offered in prizes and "the Committee are prepared to award additional prizes to other articles which they consider deserving.". In order to test the merits of the different ploughs submitted for competition, ploughing matches will be arranged, and by this means the comparative merits of various improved ploughs will be brought home to a large mass of cultivators who seldom have an opportunity of seeing these implements in actual work. Another feature which is worthy of praise is the distribution of selected seeds to cultivators at the close of the show. It is not generally known that some of the best white wheat grown in the Province comes from the Buxar sub-division where this show is to be held. The publicity which will be given to this fact by the proposed distribution of seeds must give a healthy impetus to the cultivation of good wheat. The ordinary cultivator frequently uses the inferior seed simply because he does not know where or how to get any better, but once the knowledge is brought home to him, we expect he will take advantage of it, especially if he be aided by the Agricultural Department who should take measures to establish depots where selected seed may be bought for a fair price at convenient centres. Want of space prevents our adding more than our heartiest wishes for the success of the Barahpur Agricultural Show.

An Agricultural Exhibition will be held at Habiganj on the 5th, 6th and 7th January 1880. There will be four sections of exhibits. The first section will include live-stock, such as bulls, cows, bullocks, buffaloes, ponies, sheep, goats, and poultry. The second section will include agricultural instruments, such as ploughs, sugarcane-mills, oil-mills, cotton-cleaning machines, and other implements of agricultural use. The third section will include agricultural produce, grain, pulse, tubers, fibres, cotton, and wool, oil-seed, sugarcane, molasses, dyes, tobacco, etc. The fourth section will include all kinds of arts and manufactures. Prices to the value of Rs. 500 will be awarded at the conclusion of the show. It is one of the signs of the times that with the view of agricultural improvements agricultural exhibitions are being held in various parts of India. It will not therefore be out of place to quote the warning of the Director of Agriculture of Bengal. "What it is intended to deprecate is the holding of agricultural exhibitions as mere shows, ending in show, and producing no practical results."

For three successive years an Agricultural Exhibition has been held at Kishenganj in the district of Purneah, for the purpose of introducing improvements in agriculture, agricultural implements, and the breed of cattle. The exhibition will be again held in January next. Sayyed Atta Hossein Zemindar of Khagra, who has always been a great supporter of the exhibition has given Rs. 1,000 to be invested in 4 per cent securities, the interest of which is to be laid out in providing two medals to be called the Rivers Thompson medals, to be awarded annually at the Exhibition. One medal is to be given to the owner of the best pair of plough-bullocks, certified to have been used by the owner for plough work during the 12 months preceding the show, and the other for the best show of any named kind of agricultural produce, the description of produce to be selected by the District Officer. The Lieutenant-Governor has recorded his appreciation of the efforts of Syyed Atta Hossein to promote a better system of agriculture, but suggests that the medals should be in the name of the donor.

We have received a copy of the Report of the External Land Trade and Rail-borne Trade of the Bombay Presidency for the official year 1884-85 supplemented with a memorandum on it by Mr. Ozanne, Director of Agriculture. The entire rail-borne tracle for the Presidency during the year was 63 million against 59 million maunds in the preceding year, and was valued at 47 crores against 44 croses in 1883-84. The trade thus shows an increase of 7 per cent in weight and 6 per cent in value. The acreage under cotton, wheat and oil-seeds, the three chief articles of export to Europe, has largely increased during the last 16 years, *viz.* the increase is nearly 12 lakhs acres in the case of cotton, 10 lakhs in the case of wheat, and 6 lakhs in the case of oil-seeds. The total imports into Bombay for foreign shipment during the year show an increase of 8·24 per cent, over those of the previous year. The Report shows throughout repeated evidence of the fact that it is most unsafe to draw general deductions from imperfect and untrustworthy

statistics, and that an official, not intimate with the habits of life of the people is hardly qualified for such work. Thus commenting on the increase of the trade above referred to, the examiner of guaranteed railway accounts who drew up the report, ventured to believe that it was caused (1) by the greater activity of the trade with foreign countries, (2) by the expected outbreak of hostilities on the North-Western Frontier, (3) by the warlike preparations between China and France, and (4) by the fear of the occurence of famine or scarcity in certain parts of India. Mr. Ozanne, while admitting that the increase was no doubt partially due to a greater activity in the trade with foreign countries, repudiates the other three suppositions as entirely groundless. His comments on the state of the trade in cotton twist and yarn are full of meaning.

Mr. Ozanne says, " The cotton twist and yarn imported into Bombay from the up-country spinning and weaving mills is intended for the China market. In the absence of statistics to show the export of this article from Bombay to China, I cannot say how far the trade has increased and how far this increase, if any, was due to the war between France and China. But it was an admitted fact that production in the India mills runs far ahead of demand and in some cases shipments were forced though the prices realized in in China were below the actual cost. It is possible that the increase in the export of Indian cotton twist and yarn may be due to this over production rather than to the war."

Among the various errors in to which the reporter has fallen in his attempts at general deductions, we can not help mentioning one which casts a considerable degree of suspicion at his knowledge of handling facts. In the table attached to the report, showing the total yield and exports of the principal articles of commerce, the total yield of raw or seed cotton has been given as 13½ million maunds, and the total export as nearly 3 million maunds. The reporter not knowing or perhaps forgetting that cotton was never exported without being previously ginned either by steam machinery or the charak, concluded that out of the total 13½ million maunds, very little was exported, while the major part remained in the country for local consumption. From this he deduced the general conclusion that the " hand-loom weavers of the country do not suffer much by the competition of European and Indian mills, because a large quantity of raw cotton is retained for home use" Mr Ozanne easily exposed the fallacy of the deduction by showing that the 3 million maunds of export referred to cleaned cotton; and as the proportion of seed cotton to cleaned cotton was 3 to 1, the 13½ maunds of raw cotton would be reduced to 4½ millions, out of which 3 millions was exported, leaving only 1½ millions or 39 per cent, and not 79 per cent of the total produce for native manufacture. The words of Mr. Ozanne which we reproduce below can not fail to excite universal sympathy and compassion on behalf of this important class of our artizans. "That the hand-loom weavers in the mofussil have suffered and do suffer terribly owing to the hard competition with the spining and weaving mills in India and the United Kingdom is a well-known fact. During the famine of 1876 in most of the British districts, they were among the first to succumb to the calamity, and in some districts special measures were adopted to alleviate their sufferings. Nothing has happened in the interval which could have wrought a miraculous change in their wreatched condition."

A specimen of blotting pad manufactured by the celebrated ink manufacturer, Stephens of London, has been sent to us by Messrs Harish Chandra Bose & Co. of 84 Radha Bazar Street, Calcutta. We have been much pleased at the neatness of its execution.

1. Memoranda on the Prospects of the Rice-Crop in British Burma, the Cotton-Crop and Wheat-Crop in the Bombay Presidency, the til, Rice and Cotton-Crop in the Central Provinces, the Cotton-Crop of the Hyderabad Assigned Districts, and Coffee Crop in Coorg: From Government of India.
2. Report on the External Land Trade and the Railborne Trade of the Bombay Presidency, exclusive of Sindh for the official year 1884-85: From Government of Bombay.
3. Accounts relating to the Trade and Navigation of British India for the Month of October 1885: From Government of India.
4. Memorandum of Cotton in Assam: From the Government of Assam.
5. Returns of the Rail-borne Traffic of Bengal for the quarter ending 30th June 1885: From Government of India.
6. Report of the Agricultural and Horticultural Society of India for November: From the Secretary.
7. Journal of the Agricultural Student's Association, Madras for September and October: From the Secretary.
8. Report of the Ploughing Demonstrations held by Mr. S. Samy Iyengar of Tinnevelly: From the Author.
9. British Burma Gazette: From Government of British Burma.
10. Annual Report of the Botanical Gardens, Poona, for 1884-85: From Government of Bombay.
11. Prospectus and List of Prizes of the Barhapur Agricultural Show: From the Secrtary.

Thanks of the Editor are recorded for all the above contributions.

THE WHEAT TRADE IN INDIA.

The question of improving the trade of Indian wheat has been very properly engaging the attention of the Government of India. A mass of reports and figures has been printed and circulated. With the bulk of these I need not trouble your readers, but I am anxious to call their attention to one or two points in the discussion which are of vital interest not only to the agriculturists of this country, but to all who are influenced by the present depreciation of silver. It is obvious that anything that would stimulate the export of wheat from this country would improve the condition of cultivators and grain-dealers, and to some extent at any rate check the present downward tendency of the poor rupee. Now the fact that wheat can be grown over large areas in India which equals in quality any wheat that can be grown elsewhere has been demonstrated by Dr. Forbes Watson and others. It is however notorious that Indian wheat as exported to London does not obtain the prices that one would expect grain of such quality to realize. In other words, the Trade in Wheat is not so remunerative as it ought to be. The reason that Indian wheat is depreciated in European markets is well known. It is adulterated not only with foreign matter such as dirt and other grains, but also white and red varieties are mingled in every bag of wheat that is sent out of the country. This being so, let us consider, *first*, whether it is impossible to avoid these adulterations which keep down the price of Indian wheat, and, *secondly*, provided it is not impossible, what are the best means for checking such adulterations.

The impure condition of wheat as exported may be due to one or more of the following causes. (1) The common practice of growing two or more crops on the same land at the same time may be responsible for the presence of foreign grains. (2) Imperfect arrangements for winnowing and cleaning grain may lead to the presence of dirt and other still more objectionable foreign matter. (3) There may be wilful adulterations by cultivators, traders or others.

As regards the first cause, Government has done something to impress upon wheat-growers the importance of preventing the admixture of other grains with wheat, but the cultivators have not unnaturally turned a deaf ear to this piece of gratuitous advice. In the first place growing wheat by itself is a speculation that most of them cannot afford. Unfavourable weather resulting in total loss of the crop would mean ruin to some, while if two or more other crops are in the ground, the cultivator is almost sure to get some return for his outlay. There are other cogent reasons which it would take too long to enumerate; but the main point is that a ryot grows wheat not as an experiment, but as one of his modes of making an honest living. He therefore grows wheat in the way that experience shows will pay him best. The persons he has to consider outside his own family are the money-lender who supplies him with the necessary outlay and the petty dealer who will buy his grain when he is ready to sell it. These two authorities who may be comprised in one individual—for the grain-dealer frequently makes the advance necessary for the purchase of grain,—prescribe the mode in which the wheat shall be grown. The way to reach the cultivator effectively is not through collectors, tahsildars, and the members of the subordinate executive, but through the dealer who buys from him. As regards imperfect cleaning arrangements there exists a good deal of misunderstanding. Expensive machinery is by no means necessary. The present crude arrangements are quite capable of turning out a far cleaner sample than is now demanded by the Calcutta merchants. Here again it is not the cultivator who is to blame but the petty dealer who is willing to buy grain somewhat adulterated with mud and other impurities.

Lastly with regard to wilful adulteration there is good reason to believe that this is not practised by the actual cultivator. He may take no special care to clean his grain. Why should he, when he can not get a proper price for cleaned grain; but on the other hand he will not adulterate, as the fact could not escape detection, and he would get a lower price from the dealer to whom he sells, for as between the cultivator and the petty dealer there is no fixed *standard of refraction*. The dealer will buy grain and dirt together, but a small deduction is made from the price on account of the dirt. This deduction varies with the amount of refraction and therefore it does not *pay* the cultivator to adulterate. On the other hand, the dealer does not insist on absolutely clean grain and therefore it does not pay the grower to be scrupulously clean. Could the petty dealer obtain clean grain if he wanted it? Of course he could. An Indian woman with a common bamboo tray aided by her dexterous fingers can turn out every particle of foreign matter, and also with extraordinary rapidity separate red grains from white, and those that are broken or weeviled from those that are whole. That being so, why does the petty dealer not insist on clean grain? Why does he load his pack bullocks with a mixture of wheat and other things, when he might get pure grain? Simply because there is no market for clean grain. There is no market for wheat which has less

than five (or sometimes six) per cent refraction. There is the real difficulty. It is no use preaching at cultivators. For the adulteration of wheat, the Trade is responsible. The best wheat that finds its way into the Calcutta market for export to Europe contains at least five per cent. of adulteration. If the wheat, as it comes from the grower, contains, as it usually does, less than five per cent. of foreign matter, dirt or other grains are deliberately added till the required standard of impurity is reached. This is a shocking state of things but it is true for all that. Wholesale dealers refuse to pay a higher price for a purer grain, and so the petty dealer naturally adulterates up to the required point, and of course he goes as much further as he dares in the hope of escaping detection. It is practically impossible for a large grain dealer to test every bag that is brought for sale, so he frequently buys unconsciously still dirtier grain, and the final result is further depreciation in the price of Indian wheat.

I have yet to allude to another form of adulteration, *viz.* the admixture of white and red wheat. The best white wheat in Calcutta may contain as much as twenty-five per cent of red grains. It is true that soil and climate affect the colour of wheat, and a crop of ostensibly white wheat will on some soils contain a percentage of red grains; but this proportion need not amount to anything like twenty-five per cent. The admixture is in this case done, I believe, mainly by the wholesale dealers. The petty dealers get a better price for wheat with a small amount of red grain, and therefore it does not pay them to blend the two varieties. On the other hand, when the soil only grows red wheat, the petty dealer has to buy that, and be content with a lower price. Here the wholesale merchants' opportunity comes in. He buys both varieties, but before transporting to Calcutta, he mixes the grains. So that his samples of white wheat shall contain at least twenty-five per cent of red grain; for he knows that he will not get any higher price for a sample of purer grain.

When this is the state of the Trade in India, can we wonder that the price of Indian wheat in Europe remains as low as it does? The remedy is obviously in the hands of the merchants. All that they have to do is to insist on getting grain true to its sort, and free from impurities. Why do not they apply the remedy? Solely, I believe, because they have not realised that it is possible to procure what they require. It is monstrous to suppose that European merchants would not pay a better price for a better article if they knew it was to be had. It is idle to hope that a better article will be supplied if the best price can be obtained for an inferior one. The hands of Agricultural Departments are tied by the Trade, and it alone can undo the knot. The Departments could, I believe, increase the area cultivated with white wheat. They might improve the quality and the quantity; but before they can act effectively, there must be an alteration in the conditions of the Trade; and it is in the hope, that the matter may be taken up by those who have the power of influencing this important industry, that I have ventured to submit these facts and inferences for publication in your valuable paper.

D. B. ALLEN.

THE PRESERVATION OF TIMBER.

THE necessity for the artificial preparation of wood against decay has been recognized as a measure of private and public economy from time immemorial. The difficulty of procuring good timber in the United States of America, has been so enhanced of late years, from the past wholesale destruction of forests, that national attention is now being devoted not only to the question of conserving the remaining forests but to the problem of preservation of timber from deterioration when employed for constructional purposes. The scarcity and dearness of timber in Europe have caused attention to be devoted to the subject for more than a century, but the outcome of this hundred years' experiment and trial has been found inapplicable to the new world, where timber is more largely used, and where the processes which have proved successful on a small scale have been found relatively too costly for adoption under wider and different conditions. Therefore, the efforts of American experts have been directed towards discovering some cheaper antiseptics, or specifics which would be more potent in smaller quantities than had been found to be requisite in Europe. The matter was taken up by the leading technical institute in the country, and the results of its inquiries have been publicly made known in professional journals. We learn therefrom that methods which have been successful in one country have been found to be a failure in another, and these and other variations are so great and numerous as to engender doubt whether any method of wood preparation against decay could be pronounced successful. Notwithstanding all that has been said and written on the subject, we learn that "there are few antiseptics which have stood the test of time, or have been worked commercially." Nothing has ever proved "permanently successful." In

England alone, from 1832 to 1848, no less than a dozen patents have been registered for "preserving processes," of which perhaps, KYAN and BURNETT, are those best known. Bethett's process will, however, long live under the name of "Creosoting." One and all these processes mean simply impregnation by some chemical compound, the mode of application being by absorption through immersion or suction and pressure. The substances employed in—(1) Kyanizing is corrosive sublimate; (2) Burnetting is chloride of Zinc; and (3) Creosoting is creosote or pitch oil.

In regard to the *first*, the process consists in steeping the timber in a solution of the chemical 3 per cent strong by weight. It involves time, which is a great disadvantage; and the item of cost is not all that could be desired. The results are not very satisfactory—those in moist situations being most unfavourable. As for the *second*, "Burnettizing" by Bethott's process of pressure is that most followed now a days. In this operation the preserving liquid is *forced* into the timber, previously exhausted of sap, air, and moisture, in a closed iron cylinder. The preserving liquid is dilute chloride of zinc, which solution is forced into the "exhausted" cylinder under a high pressure maintained for several hours. The results are not very favorable on the whole; but it is recommended as the best available process for the preservation of railroad ties or sleepers. The cost is not deterrent; but the operations are surrounded by too many factors of doubt. Anent the *third* or "creosoting," the method of injecting the timber with hot pitch or tar oil is essentially the same as that described in the last process of a closed cylinder and pressure. The success of the operation, which is due to Bethett, has given rise to many improvements and devices to cheapen or extend the coal tar treatment of preserving timber. The general conclusion regarding 'Creosoting" is that it is the *best* of all known processes, and for "for timber "in very wet situations or exposed to marine worms, "it is the only method which ensures success." Among the modifications of Bethett's original process, "Seeley's process" of employing Creosote; "Robbin's method" of using coal tar; "Thomas' application" of resin; and "Foreman process" of applying arsenic deserve mention. The Seely process consists in immersing the wood in a closed iron tank full of the oil, and raising the temperature to 212° and up to 300° F. The process is believed to use too much creosote. Robbin's patent was for smoking wood with the vapours of coal tar and creosote. Thomas' proposal is to immerse the timber in resin oil. Some favourable results have been achieved by the use of crude petroleum; but it has been proved that complete saturation is necessary from the volatile nature of this substance. The "Sulphate of Copper" process has some claim to attention. The first experiments were tried by vital suction,—that is, "by tapping "the living tree, and allowing the ascending "sap to carry up a preserving solution." But this was too speculative, and hence arose the after process of a one per cent. solution of sulphate of copper forced through the pores by hydraulic pressure. The process has been extensively used in France with great success, and many modifications have been registered, which have not as yet commended themselves to the profession abroad, owing to "the "necessity for operating on freshly cut logs." The Americans, with national ingenuity, have *reversed* this process, and with a suction pump the preserving fluid is *sucked* up "through the pores "or sap cells of the wood." It is not necessary to go into the "thousand and one" patents and processes taken out and devised for this one same object—"timber preservation." The anti-septic qualities of salt and arsenic have been used largely in many of them. It is said, beyond question, that arsenic was used by the ancient Egyptians; while the *cause* of the incontrovertible fact of wood having been preserved for over forty centuries is still enshrouded in mystery. Modern research has failed to rediscover the lost art.

In conclusion, it is only necessary to follow the inquiry into the source of decay in timber. It has been demonstrated that decay originates with *sap*, and that woody-fibre alone will not decay. Fermentation is the forerunner of decay, and therefore, the germs from which fermentation emanates, must be removed or rendered inoperative. Water and moisture promote fermentation, and air and temperature are allied factors towards inducing decay. This is under the operation of natural causes. But there is another source of destruction which is more dangerous to cope with, and that is the attack of insects, such as the *termite* and the *teredo navalis*. The first is well known in India and all tropical countries as a most deadly pest under the common designation of white ant; while the other is present in sea-water everywhere, particularly in temperate latitudes. So that the selection of the process will in a measure depend on local conditions. But, whatever the process employed, the method of injecting the chemical in closed cylinders under pressure is acknowledged to be the best and the most practicable. The variety of wood is an important consideration. Some timber are open-grained while others are dense. Well-seasoned timber is a *sine qua non* for every opera-

tion except the Boncherie, or copper of sulphate process which, as already stated, can only be applied to freshly cut logs. It is always best to operate upon the cheaper woods, which may be thus made to outlast the best wood at a a smaller total cost. This is only the procedure to be adopted when the advantage of preserving timber against decay has been duly weighed, and it has been found advisable to undergo the additional expenditure for protection. The matter is a question of finance and expediency, which abundance and cheapness of supply in some countries render nugatory.

THE DUTIES OF AN AGRICULTURAL DEPARTMENT.

We have been lately watching with deep interest the proceedings of the newly created Departments of Agriculture in the different provinces of India. Difficult as is the task which the Departments have imposed upon themselves, it is by no means surprizing that very little or nothing has as yet been done towards its achievements. The purposes and duties of the Agricultural Departments as set forth by Her Majesty's Secretary of State in a letter to the Government of India, dated June 1881, included:—

"**Firstly.**—More complete and systematic ascertaining and rendering available of the statistics of vital, agricultural, and economic facts for every part of India, in order that Government and its officers may always be in possession of an adequate knowledge of the actual condition of the country, its population, and resources.

Secondly.—The general improvement of Indian agriculture, with the view of increasing the food-supply and general resources of the people.

Thirdly.—Better and prompt organization of famine relief, whenever the actual approach of famine may be indicated by the statistical information.

The objects thus delineated may be briefly designated as agricultural inquiry, agricultural improvement, and famine relief."

Although agricultural improvement and famine relief should be the chief aim of an Agricultural Department, it should be distinctly borne in mind that its first efforts should be directed towards a systematic prosecution of *agricultural inquiry.* The resolution of the Government of India of December 1881, is equally pronounced on the point:—

"The views of the Government of India may be summed up by saying that the foundation of the work of an Indian Agricultural Department should be the accurate investigation of facts with the view of ascertaining what administrative course is necessary to preserve the stability of agricultural operations. It is desired therefore that the new departments should be so constituted as to give the fullest effect to this policy. The primary efforts of the departments should, when established, be devoted to the organization of agricultural inquiry, which has been shown to comprise the duties of gauging the stability of agricultural operations in every part of a province, of classifying the areas of the province according to the result of careful investigations, and of deciding what method of administrative treatment is suitable to each, so as to maintain agricultural operations up to the highest standard of efficiency possible under present conditions From a system of agricultural enquiries thus conducted will follow the gradual development of agricultural improvement in its manifold variety, and the Government of India will be satisfied if, on the first constitution of an Agricultural Department, the organization of agricultural inquiry is placed in the hands of qualified officials, to whom may be committed the subsequent preparation of carefully considered proposals for agricultural improvement."

It is well known that in many quarters a good deal of misapprehension exists as to the duties of an Agricultural Department. Enthusiasm and over solicitude for the improvement of our apparently rude agriculture have carried away many, who have not stopped to examine the path which is to lead to their cherished goal. Manures, good and costly implements, agricultural experiments, and model farms seem to be the popular cant. That such things are very desirable no one will deny, but before they are to be taken in hand, a thorough and comprehensive inquiry must establish the circumstances which may call for the adoption of such measures.

Be it further understood that of the various objects which the Government have in view, the foremost is dictated by a statesmanlike desire to raise the immense mass of our agricultural population which in other words means the nation itself—from the state of physical degradation to which it has lapsed from insufficient nutrition. Elsewhere as in the West where agriculture like all other industries is depending less and less every day on the skill and industry of *man,* it is the efficiency of *machine* and not of *man* which is carefully studied and promoted. What is done by man and machine in more advanced countries is done by man alone in India. In fact, man is a living machine, a flesh and blood machine as he has been called. Physiologically speaking, he has much of a steam engine; to make him yield a certain amount of work, he has to be fuelled just as much as a steam engine; to make him work properly his limbs should be kept in

proper order in the same way as the several parts of a steam engine. Thus as elsewhere, people try to keep their machine up to the highest standard of efficiency, it is most imperative on our Government here to see first of all that the millions of our ill-fed tillers of the soil should improve in efficiency and working power. The physical improvement of the ryot and his cattle should form the substratum of all agricultural improvements. To this end it is not sufficient that a more scientific and hence more paying system of agriculture should increase the produce of the country but that a reasonable proportion of it should be *secured to the actual cultivators of the soil.* However improved the state of agriculture may be, and to whatever extent the total yield of our land be increased, it is idle to suppose that the ryot will be benefited by it unless protected by a system of wise land legislation against the aggressions of his more powerful neighbours. Behind the dictates of philanthropy, there are others which tell us that the welfare of the Indian ryot should be the great aim of our statesmen. The prosperity of India is most intimately bound up with that of the cultivator, for from the exercise of his own muscles and of those of his pair of bullocks flows the almost entire wealth of the country. Let any one seriously contemplate the stupendous nature of the task herein proposed, and see what countless difficulties and obstructions stand in the way of its realization. The present state of the ryot has been brought about, no doubt, by a great *plexus* of influences, some of which may be physical, some social, while others are doubtless incidental to land legislation. But before we set about our task, we must first of all collect all the evidence available, shift and examine it and thus discover and analyse the various causes which have conspired to depress the state of our agricultural population. For, as a physician would be denounced as a quack if he was to treat a patient without knowing the actual disease he was suffering from, he would be none the less stigmatized who went about improving the state of the ryot without first enquiring what were the evils he was suffering from and how best they could be met. If, as we have said before, agricultural enquiry should precede all agricultural improvements with a view to ascertain whether the people are ready to receive them and likely to benefit by them, the all-importance of agricultural enquiry becomes so much the more evident where such complex causes as have brought about the present lamentable state of the ryot are involved.

We have hitherto tried to demonstrate that agricultural enquiry should be the preliminary to any attempts to reform our existing husbandry, or to relieve the ryot from the state of chronic starvation in which he is generally suffered to live. We need hardly point out that the need of such enquiry becomes the most pressing on the question of famine relief. A perusal of the Report of the Famine Commissioners will convince any one that no efficient relief is possible without the establishment of a permanent machinery for the continuous and systematic recording of agricultural information. The investigation of the Commissioners have brought to light many facts which make it imperative that such collection of information should extend from village to village, and not be confined to certain areas selected for convenience. Thus it appears that in the midst of a country known to enjoy perfect immunity from famine, there are tracts, nay often very limited areas, which are periodically visited by it; while on the other hand, the reverse is equally often met with. Under such circumstances how is accurate prevision possible unless the agricultural condition of every village be carefully and minutely recorded? Besides with the imperfect means of locomotion which we possess at present, more care and foresight have to be exercised than will be otherwise needed. It is to be hoped that the Agricultural Departments should give more consideration to the subject of agricultural enquiry than they have hitherto done; else the disasters of the Orissa and Madras Famines may be yet repeated, and the authorities may find themselves too late in the execution of their philanthropic mission.

In our next issue we will take up the subject again, and indicate the means to be adopted in order to a regular prosecution of agricultural enquiry.

HOW TO SELECT MILKING COWS.

OUR milkmen (Goalas) and householders need not be told what are the milking points of cows. They know very well, more so than would appear at first sight, that the cows to be good milkers should have a feminine appearence distinctly marked from any masculine tendency, a deep hanging belly with deep udder and soft long teats, and other good points about them, such as fairly thin mellow and oleaginous skin particularly about the udder, soft and fine hair, deep and large barrel, short neat and trim legs etc. They are also very particular about the milking properties of the dams of whom they are descended. But very few of them are aware of the system of selecting cows by the escutcheon, first discovered by

a French-man named Guenon. The system is based on the discovery "that on the posteriors of the bovine race reaching from the vulva and extending down over the udder and on the inside of the thighs, a portion of the hair grows upwards and is easily distinguished from the sorrounding hair growing downwards. In so doing the upward hair takes different shapes which he (Mon. Guenon) called Escutcheons." The quantity of milk a cow will give, the quality of the milk, and the length of time she will continue to milk, are indicated by the size, shape, and nature of her escutcheon.

The escutcheon theory in common with all new theories when first propounded met with a very cold reception at the hands of farmers and dairymen. Even at the present day the escutcheon system of selecting cows has got very little hold on the cow-keepers of the most advanced countries in Europe. About ten years ago a Commission was appointed by the Pennsylvania State Board of Agriculture, to examine into the value of the system for ascertaining by outward marks the true value of every cow. Mr. Hazard who served as secretary to the Commission points out that "the system has met with some derision, because they (unbelievers) supposed, without studying the book, that that was the only point he made as a guide to the judgment of the farmer." Whereas Guenon judged by ten points of which escutcheon was one and it is but due to the discoverer that the system should be given a fair trial before discarding it as perfectly useless or quite chimerical.

The points by which he judged a cow, may be summarised as follows :—

1. The skin. 2. The hair. 3. The conformation. 4. The age. 5. The period of gestation. 6. The health. 7. The feed. 8. The breed. 9. The size. 10. The escutcheon.

The theory of escutcheon has very recently received a practical confirmation in the United States. There no animal of any importance is now advertised for sale without stating what grade of escutcheon it bears. The work of the commission above referred to is thus bearing its fruit. In the words of Mr. Hazard, "it has elevated the grade of stock throughout the United States, has caused the selections to be more accurately made, and has saved farmers many thousands of dollars."

This system of selecting cows is not a new thing nor a thing of a day. Various agricultural societies of Europe and the Government of France have adopted it after ample trial, though it has never been popular nor generally accepted. In India it is perhaps not too much to say that even the name of escutcheon has never been heard of. We therefore propose to give a short sketch of the system and to indicate its usefulness.

Mon. Guenon classifies the various *shapes* of escutcheons into ten Classes, each of which he subdivedes into six Orders, according to their dimensions. Each class represents a gradual reduction in the quantity of milk given and each order represents gradual reduction in time. A cow of the first class and first order will have a large escutcheon of the particular form as given in Fig. I. Similarly Figs. II. and III.

FIG. I.

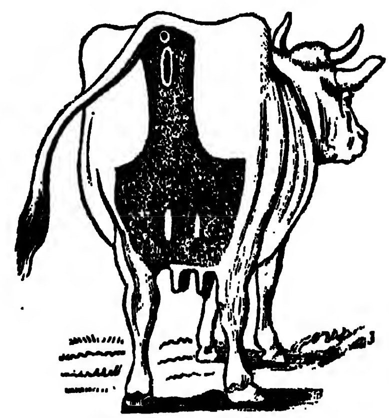
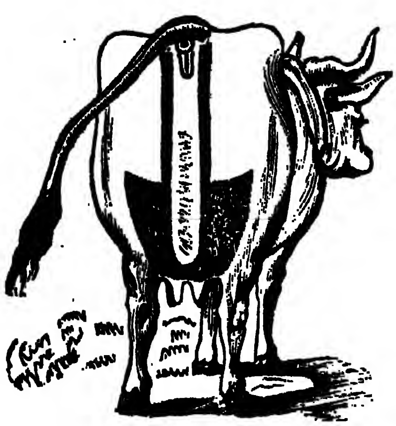


FIG. II.

FIG. III.



represent fourth class first order, and sixth class first order respectively. A cow with an escutcheon of the first class and first order yields the largest quantity of milk and milk the longest period. So on with the other classes and orders.

For the information of those who might be interested in the matter and disposed to carry on investigation on the subject with Indian cows, we reproduce below a passage bearing on the distinctive features of escutcheons, from a summary of "Guenon's System of Selecting Cows by the Escutcheon" which appeared in the last number of the "Journal of the Royal Agricultural Society of England."

"The escutcheon is that surface of the udder, the perinæum, and the thighs, where the hair grows upward. On all the remainder of the animal the hair grows downward. Escutcheons extend, according to their class, from the centre of the four teats to the level of the upper extremity of the vulva, and may extend in breadth from the middle of the hinder surface of one leg to the middle of the hinder surface of the other. By their form or configuration, escutcheons characterise and distinguish the ten families which together constitute Guenon's classification.

"Each of the *classes*, or families, is of fixed form always similar to itself, but variable in the dimensions of its surface, and is estimated by the limits of the escutcheon. The extreme limits are the hams, the udder, and vulva. It is the variation of the extent of this surface which divides each class, or family into six *orders*. The escutcheon of the first order is the most developed, and is also the best marked; that of each of the lower orders is similar in form to the first order, but is in reduced proportion, or with the dimensions reduced, or brought into less extended limits, reaching no longer the hams, nor covering the interior of the thigh, nor yet reaching up to the vulva. In any case, the broader it extends upon the thighs, the lower down and higher up the broad part covers, and the higher up and the broader the vertical portions are; and the more perfect and equal, or uniform in shape of its class it is, the better is the escutcheon.

"The lower half, or broad portion of the escutchon is of nearly similar shape in all the classes; only in the lower classes it is not quite so broad, nor quite so high up, as in the better classes; while the vertical portions gradually diminish both in height and breadth, until, in the tenth class, there is none at all. We, therefore, in speaking of the escutcheon, divide it into two parts. The lower portion, or broad part running on to the thighs, we call the thigh-escutcheon; the upper portion, which extends up to the vulva, or towards it, we call the vertical portion. The thigh-escutcheon in all the classes resembles a round-pointed shovel; while the vertical portion may be likened to the handle. Now, remembering this fact, that the vertical or upper portions are what mostly distinguish the different escutcheons, will show that most attention is to be paid to the vertical part; also, it is about the upper part the blemishes usually appear which detract from the value of the escutcheon.

"The lower part, or thigh-escutcheon, indicates the quantity of milk the cow will give: the upper portion, or vertical escutcheon, the time she will milk and the colour of the skin, the feel of it, and the character of the hair on the escutcheon, will tell the quality of the milk. And these three points must be judged partly, also, by two other matters,—the size and the breed of the cow. The nearer any cow comes, in hair and mellowness of hide, to the characteristics of a first-class Jersey cow, the nearer she comes to first quality for richness of milk and for butter.

"The effect produced by the change in the direction of the growing of the hair, which forms the escutcheon, is not glaring on the animal. It is merely a difference of lustre and the gloss on the surface of the escutcheon, from the part of the skin surrounding it. The hair of the escutcheon is finer, shorter, more furry, and more silky. Its appearance at first glance makes one think this part of the animal has been shaved, and is perhaps quicker seen than the hair on the rest of the animal. It is more easily seen in summer, when the hair is shorter, and usually the animal is cleaner, and the hair more glossy from the nature of its feed; also, it is to be seen better when the animal is near her period of calving, or just after it, as the udder, the veins, etc., are more distended. The drawings of Guenon represent the escutcheon as it would be seen if the skin of the udder and the escutcheon were stretched upon a board; and it oftentimes can be seen much better and more truly if the thighs are stretched apart, and the skin distended by the hands."

A FEW WORDS ON FOOT-AND-MOUTH DISEASE.

WHATEVER might be the disease from which a cow was suffering, provided she was dull, feverish, had a slight cough, stood still, and unwilling to eat and drink, the ordinary *munshi* who generally attended on her in such cases, would tell you that the animal was suffering from 'small-pox.' Indeed, the common *munshi* seems to have the belief that just after the rains have fairly set in, what he calls 'small-pox' usually breaks out amongst cows. In some cases, the disease is attended with eruptions on the skin of the animal and in others no such eruption is visible. The pathognomonic symptom of his 'small-pox' in the cow is the unwillingness of the cow to let him handle her mouth and limbs. Thus it happens not unfrequently that he mistakes fever, catarrh, foot-and-mouth disease etc., for 'small-pox.' It is fortunate that his medicines, are not, so far as I have been able to gather, harmful. The panacea he uses for all these diseases is only powdered leaves of Melia Indica (*nim*,) made up into a paste and given as a ball, or with water, two or three times a day. Melia Indica (*nim*), has always been used as an anti-febrile agent as well as a mild aperient, and it thus happens that in many cases our native veterinary surgeon succeeds in curing his patients.

The fact is that during the rainy season, cows seem to be specially subject to the attack of diseases in which stiffness of the limbs and extreme dulness are very marked. A case of true cow-poox [Variola vaccina] I have not yet seen; what the *munshis* ordinarily call 'small-pox' has appeared to me, in the majority of cases, to be either foot-and-mouth disease or an aggravated form of Catarrh. The latter seldom causes much harm beyond a little emaciation; and with a drench of 8 oz. of linseed oil and an ounce of nitre, repeated twice daily if necessary, proper housing free from wet, cold and draught and judicious diet, it may be cured in four or five days. In many cases, proper housing and dieting are all that is necessary, nature assisting in the cure of the disease by bringing about spontaneous diarrhœa and profuse urination.

In the case of foot-and-mouth disease however there is great danger not only of the disease spreading to all the animals of the house, or the neighbourhood, but also of abortion, if the affected animal be in-calf and be driven about from one place to another while suffering from the disease. The malady itself is seldom fatal except in case of calves, but it is a panzootic disease and milk from an affected animal is almost poisonous if drunk fresh. Owing to these reasons a short history of the disease and its treatment will not I suppose be uninteresting.

The incubation period is usually from 1 to 4 or 5 days, during which dullness and a rise of temperature are manifested. Shivering fits like those of fever and loss of appetite may also be noticed. As a rule, however, with us these symptoms pass unnoticed, and the disease is perceived only when there is considerable difficulty of mastication in the animal or when there is great salivation. Paddling of the feet, frequent movements of the lips and jaws precede or accompany the formation of *vesicles* in those parts. The presence of these vesicles is characteristic of the disease. They are few in number and are seen on the inside of the lips and upper surface of the tongue, and are often as big as an Akunda-fruit (Jatropha multifida), whitish or yellowish white in appearance. In the feet the vesicles are formed around the coronet, and especially towards the heel; also deep down between the inter-digital space. In the mammary gland, the teats form the seat of the vesicles.

The vesicles soon burst, the epithelial tissue covering them gets removed and a raw surface is thus left bare. Sometimes the whole of the phalangeal region and a portion of the metacarpal are involved in one mass of raw-tissue. The animal rapidly falls in condition and if urged about from place to place in this condition, it naturally falls which may and does frequently bring about abortion.

If the teats are not affected, the milk drawn from an affected animal, which is curiously enough very rich in fat, may be drunk after being well-boiled, but on no account *raw*.

Convalescence is restored as a rule in a fortnight's time, unless the case is extremely mismanaged.

Treatment. (1) Prevention. Isolation of affected animals and disinfection ought to be carried out directly the disease is perceived. Putting the diseased animal in a room by itself, and spreading chloride of lime or crude carbolic acid or disinfecting powder on the floor are often enough. The cow-keeper should wash and disinfect himself well before and after he feeds or medicates the affected animal. Many cow-keepers burn sulphur in the room—not a bad practice, but it should not be overdone. The dingy little holes in which affected cows are kept, if over-saturated with the fumes of sulphur, may kill both keeper and cow. Oil-cloth as a cover on his clothes is not necessary for the keeper, a few slips of Banana leaves tied around the waist over his rag will suffice. The floor, and manger should be well scrubbed with hot water after the cow is cured.

(2) *Curative.*—The disease must run its course. The treatment consists in specially administering to the strength of the animal and with this view, bland soft food should be given with plenty of cold water. As to the medicinal treatment, give the animal ¼ oz. of salicylic acid with cold water twice daily, and wash the feet and mouth thrice daily with water in which a little salicylic acid is dissolved in the following proportion:—

4 table spoonfuls of the powder
4 quarts of hot water.

A little dry powder may be sprinkled over the feet after washing.

During convalescence the diet of the animal should be carefully looked into. It is very necessary that it should not be over fed. After three weeks, the animal may be allowed to run with other animals, provided of course that the sores have all healed up by this time.

Gentlemen keeping Short-horn bulls and cows, or any English cows (I have seen some crosses between Galloways and Short-horns in Calcutta) ought to be especially careful about this disease, as these animals are more liable to and suffer more from it than any of the native breeds.

A. K. Ray.

FISH CURING

A SHORT ECONOMIC NOTE.

The important part played by *Fish* in the dietary of the Indian population is, perhaps, as much exemplified in Bengal as anywhere in India, but in this part of the country, most of the fish taken is consumed fresh, as much from the demand as from the absence of facilities and inducements to cure or salt, still, withal, within the delta of the Ganges, curing operations are carried on during certain periods of the year—as, for instance, at Goalunda, when the "*hilsa*" abounds in the Pudma, at which time fleets of fishing boats are engaged taking this delicious fish, which is largely cured for the Calcutta and other markets, and even for European consumption as "*tamarind*" or *pickled* fish. The Fisheries of the Province, are, however, chiefly *fresh-water*, except along the coast line, where the conditions that obtain approximate to those of the Madras Presidency, which are essentially *salt-water*. The Government of Mr. Grant Duff has recognized the necessity for utilizing the resources of the ocean surrounding the Peninsula as a food factor of no small importance. Hence we see the Executive in that part of India encouraging fish-curing on a large scale by the issue of salt at a cheap rate for the purpose, to the coast population. Nor do the efforts of the Madras authorities end here, for officers of the Government have been specially employed to teach the fishermen a better way of curing their surplus fish, so as not only to improve the quality of the salted article, but to do so at an expenditure of much less salt than before. The outcome is that the demand for fish thus cured cannot be met. The extent of these operations may be gauged from the fact that the quantity of fish cured in the yards of the Madras Salt Department has risen from 1,336 tons in 1880-81 to 20,108 tons in 1884-85. As it is believed that there is room for a like economic industry on the shores of the Chilka Lake and of the Sunderban inlets and creeks, we may mention the fact that the results of the Madras experiments show that a pound of salt will cure somewhat more than six pounds of fish. Some fish require a larger quantity than others, as for instance, sear the flesh of which requires more salt than the thin pomphret, which requires little more than a sprinkling of salt and drying in the sun. According to the native method of curing, the proportion of salt used is very much higher than when the operation is conducted under European superintendence, and an idea of this wastefulness may be instanced in the nonuse of the refuse or remnant salt a second time, under the popular notion of its being bad or unfit for curing. There are now 123 yards for fish-curing attached to the Salt Department of the Southern Presidency, in which the apathy and ignorance of the fishing population are combatted by ocular demonstration of the causes which lead to successful results producing a good and wholesome article of diet, commanding a higher price than the badly cured article, and benefiting alike producer and consumer. The industry is as yet in its infancy, and we trust that other parts of India will follow the example set by Madras towards encouraging the capture and improving the curing of the numerous and varied fishes which swarm round our coasts.

NEWS

The report on the prospects of the rice crop in British Burma for November 1885 is as follows:—

"The area under rice is now reported as 163,603 acres above last year's area, giving an increase of 5·29 per cent. The rain which fell at the end of November does not appear to have injured the crops except in Akyab; the damage, the details of which are not known, is estimated at 5 to 10 per cent. of the crop. The crop is said to be over average in Pegu, Thongwa, and Shwegyin; it is estimated a full average crop in Akyab and Bassein; in Hanthawaddy, Amherst, and Henzada, it is slightly below the average, and is a poor crop in Tharawaddy and Prome. Roughly speaking, on more than half the cultivated area of the province the crop is a full average one, or above average; on two-eighths of the area it is slightly below average, and on one-eighth of the area it is poor crop. On the whole it will not be safe to estimate the crop at more than an average one, and according to the method of calculation adopted last year the exportable surplus would amount to about 1,000,000 tons."

The first report on the prospects of the Wheat Crop in the Bombay Presidency is as follows:—*Sind*—Returns not received. *Gujrat*—Area everywhere less than last year, except in Surat, and below average except in Broach and Surat; decrease due to insufficiency of late rains; area 250,000 acres, or 100,000 acres less than six years' average and 125,000 acres less than last year's area; condition of young crops good; slight damage in Broach from cloudy weather in November. *Native States*—Returns incomplete. *Deccan*—Area 950,000 acres, or 125,000 acres above average and 100,000 acres above last year's area; increased area due to rain being unseasonable for other early crops; young plants healthy; heavy dews or else showers looked for to bring the crops through, especially in Khandesh and Nasik. *Bombay*—Karnatic—Last year abnormally large and unfruitful area, this year area nearly 400,000 acres, or 50,000 acres above average; the increase is merely nominal, because the *jowari* crop was sown more extensively; plants healthy; cold weather has come seasonably. *Native States*—Area 75,000 acres or about average, though 25,000 acres less than last year's area.

Rice production is of commercial importance only in the Southern and Eastern districts of the Central Provinces, although there is a considerable area under rice in the north-west corner of the Provinces (including the districts of Damoh, Jabalpur, Mandla, and Seoni), yet the amount of rice exported from this tract is relatively insignificant. In eight districts the crop is of such little importance that it has not been worth while to obtain a forecast of its outturn from them. The area from which the rice exports of the Provinces are chiefly drawn includes the Chanda, Bhandara, and Balaghat Districts in the Nagpur Divison, and three Chhattisgarh Districts of Raipur, Bilaspur, and Sambalpur. The amount of rice which these Provinces exported during 1884-85 was rather over 12¾ lakhs maunds, of which 3¾ lakhs maunds were subscribed by the Nagpur and 8 lakhs maunds by the Chhattisgarh Districts. The opening portion of the past rainy season was favourable to rice, and in most districts a larger area was brought under crop than bore rice in the preceeding year. There were several good falls of rain during the hot weather months, which were of great advantage, since they enable cultivators to break up land before the regular rains commenced and so give it a period of open fallow in the hot season. Up to the end of August prospects were everywhere exceedingly favovrable, but a break in the rains commenced then which lasted in many parts for nearly two months and was only inturrupted by occasional very local showers. The rice crop of course suffered severely, and it is rather a matter of surprise that its present prospects are so good as they are reported. In many places the break commenced very shortly after the seedlings had been planted out, when damp weather is especially wanted; broadcasted rice (under which class falls all that grown in Raipur and Bilaspur) fared better, but a considerable portion of the crop on high lying ground will give but little return. Taking one district with another the highest estimate which can be made is that of a ⅔rds crop.

Speaking broadly, til represents the contribution towards the exports of the Central Provinces which is made by the poorer classes of soil, and is to a great extent a speciality of hilly ground, on which wheat or linseed cannot be grown to much advantage. The tract in which most til is grown is the Nimar District, but as most districts in these Provinces include a considerable area of rocky land, til is a crop of some importance throughout the Provinces. Its commercial importance may be judged of from the fact that during the year 1883-84 its exports amounted to over 9 lakhs maunds, with a value of 84½ lakhs rupees, rather more than the value of the rice exported in that year. The area now under til is very considerably in excess of last year's area. The increase is principally due to the fact that last year's area was abnormally small, owing to the continuous rainfall having prevented sowings. Last year's til crop was a very small one, and the exports during 1884-85 only amounted to 2,60,781 maunds against 9,02,675 maunds in the preceding year. But there are also signs that the cultivation of til is gradually extending, and the Deputy Commissioners of the Nimar and Wardha notice the effect which the brisk demand for til has had on the area. It seems like linseed to be encroaching on the area, which hitherto has been sown with cotton. The greater part of the til crop is sown in August, though in the southern districts, some is sown in October and grown as a cold weather crop. Breaks in the rainfall of August are, therefore, essential for the success of the crop, as seed cannot be got into the ground during continuous rain. It was the absence of breaks in August that made the 1884-85 season so bad a one. The weather during last August was, on the whole, propitious for til sowings, though it is reported that the rain-fall was too heavy in Mandla and Seoni. But the abnormally long break which prevailed throughout September and till the end of the first week in October has done the crop a great deal of damage, and, though some of the district estimates are probably below the mark, the outturn cannot be expected to exceed 9 or 10 annas

in the rupee, taking 12 annas to represent an average crop.

Cotton is only a crop of commercial importance over a very limited portion of the Central Provinces, and no details have been obtained for this forecast from eight districts in which it plays quite an insignificant part. During the years 1883-84 and 1884-85 the cotton exported from these Provinces amounted in value to 17 and 10¾ lakhs rupees respectively, and the proportions in which different parts of the Provinces contributed to this export in the last named year are roughly expressed by the following figures:—

Saugor, Damoh and Jabalpur	5
Narsinghpur, Hoshangabad	11
Nimar	7½
Wardha, Nagpur, Chanda and Chhindwara ...	12

An increase in the area is reported from most districts; but in estimating the character of this increase it must be remembered that its extent has been calculated on the area of the preceding year, which were abnormally small, owing to the very unfavourable character of the season at sowing time. It is not believed that the area on which cotton is grown in these Provinces, shows any tendency to permanent increase, and it is certain that in some tracts, noticeably in the Nagpur and Wardha districts, cotton cultivation is giving place to that of linseed. The past season has been on the whole a good one for cotton, and estimates of out-turn below 10 annas in the rupee are probably under the mark. The rain-fall at the end of June and commencement of July was not sufficiently continuous to hinder sowing, and there have been numerous breaks, during which weeding could be effected. The long break which continued throughout September may have harmed the crop in some places: but it is certain that cotton suffered from the deficiency much less than any other crop. On the whole an out-turn nearly, if not quite, up to the average may be expected.

The report for November on the prospects of the Cotton Crop in the Bombay Presidency is as follows: *Sind*—Area shown 56,000 acres, are up to average, but 17,000 acres less than last year; field inspections not completed *Gujrat* — Weather seasonable; plants flowering. *Native States* — Baroda — Returns incomplete; Kathiwar—area 1,775,000 acres; in other States area 300,000 acres; these figures must be received with caution; average area unknown. *Deccan*—In Khandesh picking in progress; crop patchy but excellent in parts, in others much of the sown area has been resown with other crops: rest of Deccan crop less forward. *Bombay*—Karnatic—Season late; east winds have set in, but as yet little damage reported. On the whole the area sown in British Districts is 325,000 acres below average and 300,000 acres below last year's area. In Native States, exclusive of Baroda, the area sown is 100,000 acres above last year's area. Total area, British Districts 1,950,000 acres; Native States, besides Baroda, 2,225,000 acres.

The Annual Forecast of the Cotton Crop of the Hyderabad Assigned Districts for the Season 1885-86 shows a falling off of 6·6 per cent in one for the whole Province. The healthy appearance of the plant promises the out-turn estimated. On this basis the crop of the year may be estimated at about 20 per cent over that of last year; the probable yield being put at 490,000 cwts.

The exports of Indian tea, this year, are showing a satisfactory increase. During the seven months ending on the 31st of October last, India exported nearly three crores' worth of tea; or nearly two lakhs less than the quantity exported during the same period of last year. There is a large export to Australia; but the attempt to force a way into the American market seems doomed to failure.

The exports of Tea from Calcutta to Great Britain are steadily increasing. The exports in November amounted to 11,644,612 lbs, the returns for the corresponding months of the two preceding years being respectively 9,390,037lbs and 7,140,887lbs. The total exports from the 1st of May to the end of November were 47,730,072 lbs. The trade with Australia shows an even more remarkable development. Up to the end of November the shipments amounted to 1,384,784 lbs; the amount in 1884 being only 577,518 lbs, and that in 1883, 206,536 lbs. There is also an improvement in the trade with America, although the exports to that country (70,946lbs.) are considerably less than in 1883. Altogether there is an improvement in the trade up to date, as compared with last year, of nearly five million pounds. The Ceylon trade is also advancing with rapid strides, the figures for the past three years (from 1st October to 19th November) being 101,986 lbs, 193,869 lbs, and 471,402 lbs. The exports from India to England include 534,217 lbs that were lost in the steamers *Indus* and *City of Manchester*. It must be admitted that these figures are highly favourable, especially for a time of severe and widespread depression.

According to the latest published list of tea gardens or tea estates in Ceylon, there are at present no fewer than 583 gardens either in bearing or under cultivation. In looking through the list, it is curious to notice, from an Indian point of view, the small extent of most of the gardens, for there is only one which comprises 500 acres, and by far the majority are below 100 acres in extent.

The quantity of tea exported from China and Japan to Great Britain during the season up to the 8th December, was 137,505,105 lbs, as compared with 132,489,338 lbs during the corresponding period of last year. The exports to America and Canada during the same period were 65,501,333 lbs as against 62,973,075 lbs.

The exports of plain Cottons from the United Kingdom for Bombay during the month of November have been in round figures 60 millions of yards

—the largest total on record. This brings up the average of the past three months to 46 millions per month as against 27 millions per mensem as the average of the previous, four years.

The Bombay cotton crop is proving an unusually early one, about 16,000 bales having already reached the market. The crop is expected to be one of the best, both in quantity and quality, ever known on the Bombay side of India. Estimates of the next six months' shipments range from one to one-and-a-quarter million bales.

During the month of October last 1,214 emigrants left the port of Calcutta, of whom 656 went to Demarara and 558 to Trinidad.

The assay value of coins and bullion received in the Indian mints from the beginning of April to the end of October was Rs 66 42,859, and of those coined and examined Rs 6,88,03,280. Of the latter amount Rs 2.41,67,203 was coined in Calcutta, and Rs 4,46,36,077 in Bombay.

During the first seven months of the current year the value of gold imported to this country was Rs 1,95,92,265, and of that exported Rs 17,23,056; whilst value of silver imported was Rs 7,19,22,826, and of that exported Rs 47,87,891. This leaves a balance of both metals in favour of imports of Rs 8,50,04,144.

According to the latest returns, Great Britain has taken 128 000 bales less than last season, while the Continent and United States have taken 174,000 bales more. The total deliveries to America and the Continent are this season 432,000 bales larger than the deliveries to Great Britain, while last year the excess was only 130,000, a difference of 302,000 against Great Britain. This looks bad for Lancashire trade.

It is estimated that the total Russian wheat crop for both spring and winter is six million quarters, equal to twenty per cent. below the average. Other cereals show even a larger diminution, except rye which has increased ten per cent. The condition of the population in the wheat districts is represented as deplorable.

Mr. Thomas Wardle, F. C. S., F. G. S., comes out to India with instructions from the Royal Commission for the Colonial and Indian Exhibition of 1886 to visit the silk districts of India in order to make a collection of Indian silks both raw and manufactured, with a view to stimulating the development of all the silk products of India and their utilisation in Europe.

The Indian section of the London Exhibition will be under the charge of the following Royal Commissioners:—Sir Phillip Cunliffe Owen, Sir George Birdwood, Mr. Buck, and Mr. Royle, of the India Office. Mr. Buck has had conferred upon him the honorary title of Commisioner for India. Mr. Royle will act as Secretary for the Indian section, and as Assistant to Sir Philip Owen, who is Secretary to the whole Commission.

The Nizam's Dominion will be worthily represented at the Indian and Colonial Exhibition in London next year. Already a large collection of agricultural specimens and implements, arms and clothes, have been made, and more are expected before the end of the month. The whole collection will be exhibited for a short time at Hyderabad before being despatched to England.

A Wool-growers' Association of Australasia has been established, with the object of extending the trade in wools and woollens in China, Japan, and British India. Considerable interest is being taken in the movement in New Zealand. The executive is attempting to establish a fund for the purpose of, amongst other things, sending a commission to visit the countries named.

A large selection of the chief manufactures of Hongkong will be sent to the Colonial Exhibition and an attractive feature in the court will be a bazar for the sale of Chinese goods.

It is reported that preparations are being made at Darbhangah under the presidency of the Collector to hold an agricultural Exhibition there.

The largest field of pine-apples in the world is on an estate in the eastern district of New Province, Bahamas. From one spot it is possible to see, at a single glance, 1,200,000 pine-apples growing.

A large demand seems to have arisen in the Madras presidency for what are known as the Swedish ploughs. A consignment of 250 of these was sent out by the Secretary of State last year for distribution throughout the presidency, one for each taluk, and no less than 183 were thus delivered. The cost of each plough is about eighteen rupees, and the expenses of packing and delivery were undertaken by the Saidapet Farm. The fact of the distribution has caused a large demand for the ploughs in the Bellari, Kurnal, Salem, and other districts where the cattle are generally strong enough to work them, and a good black soil prevails. Many orders for the ploughs are at present being carried out at the workshops by the Agricultural Department.

The coffee crop in Coorg is expected to yield during the ensuing year an outturn of about 3,612 tons. With three or four small exceptions, this estimate embraces every estate in the province.

The outturn is considered by the Chief Commissioner to be a favourable one, and represents about I cwt. per acre.

EXTRACT.

PETITE CULTURE.

The system of agriculture pursued in this country is, it is well-known, one of *petite culture*, and the country is virtually split up into many millions of five acre farms. It is partly the result of the excessive sub-division of land encouraged by the family system of the Hindus. But it is the cause of certain economic and moral evils. It discourages improvement and enterprise in cultivation, and sets an extravagant value on landed property. It demoralizes the cultivators; it almost reduces them to the level of the patient domestic animal. They lose all desire for improvement, become quite content with their miserable lot and endure any hardship with patience. Many cultivators work for wages in adjoining towns for some months in the year. But wages, it is well-known, have been stationary while prices have risen. Perhaps, it will do good to remind the Local Government, which is now engaged in important agricultural legislation, to remind it of the evils of *petite culture* and of the advantages possessed by cultivation on a large scale. The majority of the Indian cultivators pay rent to landlords who are intermediate between them and the State, and it is worth consideration, whether the limiting of the interest of the landlords is conducive to the benefit of the whole community subsisting upon the produce of the land and, for that matter, to the benefit of the Government itsel' Under a system of *petite culture* and low wages no improvement can be possible, and experience in other parts of the world points to the same conclusion. In an article on peasant properties contributed to the November number of the *Nineteenth Century* by Lady Verney, the condtion of the small peasant proprietors in Germany, France, and other European countries is described. We transcribed below some of the opinions quoted by Lady Verney.

Professor Voelker says of the *petite culture* of Germany and Belgium, with both of which he is well acquainted:—

"The position of the small peasant proprietors is simply wretched compared to that of a decent English agricultural labourer. Man, wife, sons and daughters, on a small peasant property, have all to work hard from early morn till night, to gain enough to keep body and soul together. They exist upon the most frugal fare, and live in dirty, crowded hovels; as regards food and housing the English labourer is unquestionably 50 per cent better off than they are . . . . . The peasants have no money to cultivate their little fields or to buy stock; the application of artificial manure, of sufficient home-made dung, and the use of labour-saving machinery are impossible in the *petite culture*. The results are everywhere the same—poor crops, bad earnings, and extravagant value put upon the land [which is considered the only mode of getting a living, as in Ireland,] and a hard and miserable existence."
—*The Hindu.*

POTATO CULTURE IN MYSORE.

By. Mr. M. Rama Row, of Mysore.

The potato (Solanum tuberosun) is cultivated to a more or less extent in various parts of India, both for local consumption, and for exportation to places where it is not grown. The method of cultivation differs in different localities according to the varying nature of climate, soil, etc. Thus, for instance, it is cultivated as a field crop in Poona, but in some parts of Mysore it is grown as a garden crop. The purpose of this article is to give a short account of the mode of cultivation pursued in the Colar District, where it is grown to a very large extent. It is there cultivated with great care and attention, as it is one of the chief money crops to the gardener.

Generally, two crops of potato are raised during the year, in summer, and in winter. The summer crop is planted from the middle of May to the middle of June, and the winter crop in November and December. The potato is considered to be a very uncertain crop, as it is liable to sudden attacks of fungoid diseases.

The gardeners are fully alive to the fact that a successive cropping of potato will injure the land, and also the size and quality of tubers. They alternate this crop with onion, garlic, turmeric etc. I have not seen two crops of potato raised successively on the same land.

Varieties:—Three varieties of potatoes are cultivated in Colar District, *viz*., Ricket potato, Nilgiri potato, and Batas potato. The first variety is the largest but the flavor is not good, and the starch (flesh) is white. The second variety is distinguished by its yellow starch (flesh) and good flavor. The third variety is of medium size, and the starch whitish; the tubers are flat.

Soil.—I have seen it growing on stiff loams, black soils, and sandy loams rich in organic matter.

Black cotton soil is the best, as the out turn of tubers grown on this de c iptirn ‹f land is very great. The gardeners say, very reasonably too, that the quality and size of the tubers are greatly influenced by the nature of the land.

Preparation of the land.—A month prior to the time of planting, the preparation of the land is begun. If the land is hard and dry, it is watered and dug to a depth of 8 to 10 inches with an instrument called Gooddaly. As they go on digging, all the weeds are removed. After this is done, the land is levelled with a wooden implement resembling a rake.

Manuring.—After leaving the land to the action of the atmosphere for 5 or 6 days, manure is applied to the land at the rate of 40 full cart-loads to an acre. This is uniformly scattered on the land and the whole surface stirred to a depth of 2 or 3 inches to effect a thorough mixture of the manure with the soil. A compost of the excrements of pigs, sheep and goats is said to be a very good manure for the potato. The land is then levelled as before, and ridged with Gooddaly, the ridges being 9 inches apart. Cross furrows are made at a distance of 2 yards for the purpose of watering the plot.

Selection and planting of tubers.—The tubers intended for planting are selected with great care. Plump, healthy and large tubers are cut into as many parts as there are 'eyes' and these are planted in the furrows at a distance of 9 inches. If the soil is moist at the time of planting, the plot will be watered on the third day, but if dry on the second day. Generally 16 to 18 maunds of 25lb each are planted per acre.

After cultivation and treatment.—This consists in irrigating the crop at regular intervals, and keeping land free from weeds. The land is watered twice a week till the end of a month. At the end of 15 days, the young plants appear above ground, and will be 8 or 9 inches high when a month old. At the end of a month, the ridges are split, the soil being put into the furrows thus making the former ridges into furrows, and furrows into ridges. It is at this period that the tubers begin to form. In the second and third months the plants are watered regularly at an interval of 3 days. By the end of the third month, the tubers perfectly develope and mature. Great care is taken by the gardener to remove the weeds as they appear on the surface.

Harvesting.—At the end of the third month, the plants begin to fade. This is a sign of the perfect development and maturity of the tubers. The plants are cut with a sickle, and heaped in a corner of the garden. The land is dug to a depth of 4 or 5 inches, and the tubers are collected. The average out-turn of tubers per acre is 300 maunds.

After collecting the tubers, they are sorted according to their size. All the small ones are heaped in one place, and the larger ones in a separate place. The heaps are covered over with the leaves of the same plant to protect the tubers from sun and rain, till a fair price is offered. Generally, the potato tubers are sold at so much per cart-load, which consists of 30 maunds or 750lb nearly. The average rate will be 15Rs per cart-load.

Probable cost of raising potatoes on an acre of land is as follows:—

	Rs	A.
Digging the land and levelling it	3	0
40 cart-loads of manure at 8 annas	20	0
Spreading the manure	2	0
Levelling the land	1	0
Ridging	2	0
Tubers for planting	9	0
Cutting and planting tubers	2	0
Watering the land	25	0
Splitting the ridges, &c.	3	0
Harvesting	2	0
Assessment of the land	6	0
Total expenditure ...	75	0
Out-turn of tubers 10 cart-loads at 15 Rs. a cart-load	150	0
Net profit ...	75	0

It has been already hinted that the potato can be cultivated as a field or dry crop. The method of cultivation for raising it as a dry crop does not differ much from that adopted for any field crop such as ground nut. The soil best suited for this method is black cotton soil; but any description of soil which can absorb and retain water for a long time will serve as well; it must however be remembered that though a large crop may be produced in a moist stiff soil, the quality of the tubers is not so good. Under this system, only one crop can be raised in a year, that is in the rainy season.

Diseases of the plant.—The potato is attacked by 2 kinds of diseases, one peculiar to summer, and the other to the winter crop. The former is characterized by the appearance of dark spots on the bottom leaves at first; these dark spots gradually extend to the whole plant. The evil

effects of this fungus, is the premature decay o the plant, and consequently an imperfect development of the tubers. The latter, *i. e.*, the fungus that attacks the plant in winter, is characterized by the whole plant turning black, owing to a dark dust-like substance covering the plant. This said to attack plants when 2 months old.—*Journal of the Agricultural Students' Association.*

CALCUTTA MARKET REPORT

FOR THE

MONTH OF DECEMBER, 1885.

Tea.—At the public sales held on the 10th Instant 14,262 packages, were offered for sale of which 13,993 were disposed of. There was a keen competition for all descriptions at very firm rates. At the London auctions held during the first week of December 19,000 packages of Indian tea were offered and 18,500 sold. There was a good demand for all descriptions at firm rates. There was another sale on the 18th at which 10,450 packages were offered and 10,370 sold. There was a keen competition for all descriptions and in many cases an advance was obtained on last week's rate. There will be no more auctions before the 7th January next. At the London auctions during the second week of December 24,000 packages were offered and 22 600 sold. Prices ruled firm.

Indigo.—During the second week of December there were four public sales at which 3,678 chests were offered and 3,544 sold. The demand during the early part of the week was unabated and the prices ruled high, especially for the defective sorts from Rs. 240 to 260 which is an advance of fully Rs. 5. Later on the sale went on rather with less animation and with downward tendency. *Oude* have continued to rule high. The total quantity out of the market up to the 14th instant was 44,500 maunds consisting of—

Bengal	...	...	9,800 mds.
Tirhut	...	...	18,750 „
Benares	...	...	4,100 „
Oudes	...	...	11,850 „

During the third week of December there were also four public sales at which 4,028 chests were offered and 3,992 sold. The demand for finer quality was less active and prices quoted were fully Rs. 5 lower; but ordinary and middling descriptions have maintained their previous value. *Oude* were higher by Rs. 20 to 25 above the opening prices of the season. The total quantity out of the market up to the 21st instant was 61,500 maunds consisting of—

Bengal	...	..	12,850 mds.
Tirhoot	...	...	28,200 „
Benares	...	...	5,800 „
Oude	...	...	14,600 „

During the last week of December 1,638 chests were offered and disposed of at public sales. There was a good demand for all descriptions and middling defective sorts were generally Rs. 5 higher. The quantity out of the market now is about 69,900 maunds, consisting of—

Bengal	...	...	14,650
Tirhoot	...	...	33,000
Benares	...	...	6,500
Oude	...	...	15.750

Wheat.—During the second week the sales reported did not exceed 500 tons, and during the third week hardly any business was done in old wheat. In new wheat, transactions took place to the extent of about 1,500 tons at Rs. 2-8 for Club, No. 2, April May-delivery.

No transactions have transpired during the last week.

Linseed.—During the second week there was a moderate demand and the sales were up 600 to 700 tons at Rs. 4-8 to Rs. 4-8-3 for small grain, 5 per cent. refraction. Of the new crop, transactions took place to the extent of about 500 tons at Rs. 4 for April-May delivery. During the third week very little transaction was done in old crop and the sales of new were restricted to about 500 tons of small grain, 5 per cent. refraction at Rs. 3-15-9, April-May delivery.

Business during the last week of December has been restricted to about 1000 tons of linseed, small grain 5 per cent. refraction at Rs. 3-15-6 and Rs. 3-15 9. April-May delivery.

Rapeseed and Poppyseed.—No transaction reported.

Jute.—Hardly any business has been done.

Market is quiet. Quotations for ordinary 1st. marks are Rs. 20-8 to Rs. 21 per bale.

Freight.— Via Cape, Jute 30*s*; Via Cape to Liverpool 27*s*. 6*d*.; and Via Cape to Dudnee 30*s*.

CROP AND WEATHER REPORT.

For the Week Ending 9th December 1885

General Remarks.—Heavy rain has fallen in British Burma and slight rain in parts of the Madras Presidency, Mysore and Coorg. Elsewhere the week has been rainless.

Agricultural prospects continue fair in the Madras Presidency though in one or two places some injury has been caused by insects and in parts of Coimbatore more rain would be beneficial. In Mysore the standing crops are in good condition, but those sown late need rain. The ragi and paddy harvests are in progress. In Coorg the season promises well.

In the Bombay Presidency kharif crops are still being harvested and rabi sown. In parts of Nasik, Ahmednagar, Sholapur, and Nasik, more rain is wanted for the latter. In the Berars, Hyderabad, and Central India and Rajputana, the cutting of the kharif crops is in progress, anp the rabi crops promise well.

The rabi showings have been almost completed in the Central Provinces and in the Punjab. In the latter province rain is much wanted in several districts. In the North-Western Provinces and Oudh the rabi crops are coming up well, but more rain is wanted in the districts of Allahabad, Banda Kumaon and Jhansi.

The rice harvest in Bengal is yeilding a good outturn and the rabi crops promise well. In Assam the state and prospects of the crops continue favourable.

In British Burma crop prospects are generally good in all districts excepts in Thyetmyo.

The public health is fair in all provinces.

Prices are generally steady everywhere except in the Punjab and Coorg, where they show a tendency to rise, and in Mysore where they are fluctuating.

For the Week Ending the 16th December 1885.

General Remarks.—During the week under report rain has fallen generally throughout the Madras Presidency, the Berars, the Central Provinces, and the North-Western Provinces and Oudh.

Slight rain has also fallen in Mysore and in a few districts in the Punjab, Bombay, Bengal and Assam. From one or two places in Central India and Rajputana slight showers are also reported.

The standing crops are generally in good condition in Madras, and those which are being harvested promise an average outturn. In Bellary and Anantapur prospects continue favourable. In Mysore and Coorg crops are good.

In parts of the Bombay Presidency more rain is wanted for the rabi crops, the sowing of which has been nearly completed in most districts. The kharif harvest in nearly over. In the Berars and Hyderabad the rabi promises well, and in in Central India and Rajputana agricultural prospects are generally good.

In the Central Provinces the rabi crops have been improved by the recent rain; the kharif is being threshed in Jabbulpore and Seoni. More rain is still wanted in the Punjab for the rabi crops. In the North-Western Provinces and Oudh the rabi crops have been benefited by the recent rains, and prospects are good.

In Bengal the recent rain has greatly benefited the rabi and poppy crops in Behar and Hazareebagh; the amun harvest is yielding a good outturn except in the inundated tracts. In Assam the prospects of the season continue good.

In British Burma the rice crop is being reaped and promises will in all districts except Tharawaddy, Prome, Thayetmyo.

The public health is generally good.

Prices are fluctuating in the Punjab and are falling in Coorg. In Bengal the price of rice is lower than last year. Elsewhere prices are fairly stationary.

For the Week Ending 23rd December 1885.

General Remarks.—Rain has fallen in all reporting districts of the Madras Presidency, where the condition of the crops continue to be favourable. In Bellary the standing crops have been much improved, but in Kurnool and Tanjore they have been somewhat injured by last week's rain. Good rain has fallen generally in the Bangalore, Kolar, Tumknr, and Mysore districts of the Mysore Province, and the condition of the standing crop is good. In Coorg the week's rainfall has been unfavourable to the crops, but in other respectr agricultural prospects continue good.

In Bombay there has been rain in most districts of the Deccan and Southern Mahratta Country and parts of Upper Sind Frontier. In parts of Nasik and Khandhesh the rabi crops need more rain. Reaping of kharif ann sowing of the rabi crops continue in some districts. In the Berars the rabi continues in good condition, but the jowari and cotton crops have been injured to some extent by the late rains. In Hyderabad the kharif harvest is over; the gram, wheat and tobacco crops are reported to have been slightly damaged by the rain. In Central India and Rajputana rain has been almost general and has been of much benefit to the standing crops, which promise well.

Good rain has fallen in the North-Western provinces and Oudh, greatly benefiting the opium and rabi crops. In the Punjab also rain is reported from every district and prospects are on the whole favourable. In Shahpur, Peshwar, and Rawalpindi more rain is wanted for the crops. In the central provinces the heavy showers of the past two weeks have been beneficial to the rabi crops except in Nagpur and Raipur, where slight damage is reported. The General rain in Bengal has been very beneficial to the rabi crops which are everywhere doing well, and to the poppy in Behar and Hazaribagh. The amun harvest is generally yielding very well except where the crop was destroyed by floods in August and September. In Assam agricultural prospects continue favourable.

In British Buema the rice crop is being reaped with prospects of a good outturn. The public health continues fair.

Prices are unsteady in Mysore and falling in Coorg. In Bengal the price of rice is generally much cheaper than last year; elsewhere prices are generally stationary.

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AGRICULTURE, ARTS AND COMMERCE.

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The most interesting feature in the fourth or November fore-cast of the Cotton and Til crops of the United Provinces, which we reproduce elsewhere, is the introduction of Zemindars, as reporting agents. The estimates given of the average yield of Cotton and Til are based mainly on the opinions of 261 reporting Zemindars. This new feature of the fore-cast is important in more ways than one. There will not only be a saving of Government money which is by no means an insignificant matter in these days of financial pressure, but the informations voluntarily supplied by such a large body of non-official personages have a greater chance of being more accurate and trustworthy. With experience in reporting and instructions from the Agricultural Department necessary for the proper performance of their self-imposed task, the Zemindars of the United Provinces will no doubt form a very valuable agency in the hands of the local Agricultural Department towards the collection of agricultural and other economic facts, the supreme importance of which has repeatedly been pointed out in these pages.

* * *

But there is another aspect of the question which has in our opinion a significance of far greater importance. The agency will be the means of giving to the minds of the land-owners in general a bent in the right direction. For having to handle agricultural statistics and rural economy of the country, they will gradually learn to appreciate the usefulness of the knowledge thus acquired and profit themselves thereby. In fact, this will serve the purposes of agricultural and economic education in the country. Once we advised a big land-owner to grow wheat as a speculation and were not at all surprised to hear from him—"where is he to find a market for it?" If he knew anything of the destination of Indian wheat or the economy of wheat growing, the above querry would have been impossible. It is to this side of the reporting Zemindary-agency of the United Provinces that we attach the highest importance. We believe that a somewhat similar agency is utilized in the United States.

We have received the first of a series of annual notes which it is proposed to publish with reference to manufactures in Assam. On this occasion, three subjects, *viz*, (1) the Brass Work of the Morias, (2) the Gold enamelling of Jorhat, and (3) Iron smelting in the Khasi Hills, have been dealt with very ably by Mr Darrah, officiating Director of agriculture, Assam. The notes under review do not pretend to exhaust the topics they deal with. They are intended merely to form a basis for a more complete enquiry hereafter and believed to afford the information available up to date on the subjects. When a sufficient amount of additional facts has been collected, the notes will be re-written. Brass utensils are generally made in Assam by a particular caste, known by the generic name of Moria. Morias are Mahomedans of low caste, with a history of their own. It would seem that they are the relics of the unsuccessful Mahomedan invasion of 1510, the survivors of which were reduced to captivity and permitted finally to embrace

the calling of braziers. The work is done in several parts of the Province, but the informations were collected in the district of Darrang. There are but two seats of the manufacture in that district. These are Moriagaon, in Mouza Binburi of the Gabru tahsil, and Moriagaon, on the Boreli river about 8 miles from Tezpur.

*

The Morias never cast brass into the shapes of vessels they manufacture. They always use sheet brass about one-sixteenth of an inch in thickness and join pieces of it together to produce the desired shape. The instruments used in the manufacture of the utensils are three kinds of anvil, four kinds of hammer, pincers, scissors, bellows, furnace, chisel, crucible, mould, wooden trough, triangular and square files and a kind of lathe. The material used in joining the sheet brass where a junction is necessary, is locally called the *pan*; which is made by melting together three parts of sheet brass and one part of solder. The result is a little brittle compound which breaks up when struck by a hammer. In melting the *pan*, the crucible is more than once taken out of the fire and rolled in a heap of rice-husks, and this is supposed to remove all danger of the clay-crucible breaking. Before the melted *pan* is powered into the mould, goats' fat is put into it.

* * *

When it becomes necessary to join the two edges of a sheet of brass, nicks are cut in one edge, and the other edge fitted into these, and the two beaten flat. Then a rough paste is made of some broken-up *pan* and borax, which is smeared over the joining. The junction is then heated. The *pan* melts, and the union is cemented. The processes of manufacture are exceedingly simple, and consist merely of beating the brass into the shape required or of uniting portions of it. Sheet brass is bought from Marwari merchants at prices varying from Rs 30 to Rs 40 per maund. It all comes from Europe. New brass is also sometimes obtained by exchanging old vessels for it. The usual rate is two seers of old brass for one seer of the new article. The general price of new utensils is Rs 1-8 per seer. Charcoal is the fuel always used. The Morias in outlying tracts, such as the two villages in Darrang, make it themselves from drift timber.

Enamelling on gold is done mainly at Jorhat, in the Sibsagar district. The artificers are Sunars, and possess a fair amount of skill. As, however, they work almost entirely for the native trade, the articles produced lack the finish to be seen in ornaments manufactured for European customers. There are many Sunars in Jorhat, who work in nothing but gold. These do not enamel, but those who enamel also work in gold. The different families engaged in the enamelling trade are believed at present to number 38. The enamel is usually of three kinds, a dark blue, dark green, and white, but red and yellow are also sometimes used. It is bought in blocks, exactly like glass slag in appearance, from Marwari merchants. The price varies from 8 annas to Rs 2 a tola. It comes from Calcutta. The tools used in the manufacture are small hammers, files, pincers, and anvils. They are said to be of English manufacture, and to come from Calcutta. Some, however, are made in Sylhet.

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The finished ornament usually shows narrow threads of gold arranged in fanciful patterns in the body of the enamel. These are formed of wire, and are laid on before the enamel. When the wires have all been put on, and the pattern which is to appear through the enamel formed upon the ornament in process of completion, some powdered enamel of the desired colour is mixed with water in a shell, and the coarse paste so formed applied by means of a needle flattened at one end to the spaces between the gold wires. These having been filled up, the ornament is fixed by a hole, purposely left in it, to the top of a nail, standing up out of a flat piece of iron such as is used for binding boxes. A half cylinder of baked clay about 3 or 4 inches long, closed at one end and perforated with hole is then placed in the furnace in a clear space which has been made for it in the charcoal, and the ornament carefully put inside. The whole is then covered up with red charcoal, and the bellows applied. Very shortly the cylinder and its contents are red hot, the enamel melts and forms a soild mass in the places it had just previously occupied in a state of paste. When cool, the ornament is boiled in a solution of lime-juice and water. It is then carefully examined to see if there are any spaces without enamel where enamel ought to be. If there are, more enamel is added, and the heating and boiling gone over again. The process of applying and melting the enamel is known as *Bharandia*. When it is finally percieved that no enamel is wanting, the workman takes up a file, and files the ornament until the surface of the enamel corresponds exactly with the upper edge of the gold wires. The latter then look as if they had been inlaid. While being filed, the article is

kept wet. It is then boiled again in the solution mentioned above, and when cool, brushed with a small bundle of hog's bristles, and filed again. This is repeated two or three times until the object presents a perfectly smooth albeit unpolished surface.

* * *

To put a polish on the enamel some care is needed. The ornament is put again under the cylinder in the middle of the fire, and red charcoal piled up around. The bellows are not used, but a hand *punkha* or fan, instead When the article is red, and it is seen that the enamel is again in a state of fusion, the ornament is taken out of the fire, and cooled with the aid of a blow-pipe. It is then boiled once more in the acid solution, and the enamel is found to be smooth and polished The last process employed puts a reddish colour on the gold. Into a small earthenware vessel a little water is poured, and the sides of the vessel rubbed with sulphur. Next, small quantities of salt, sulphate of copper, and the leaves of a tree called *thekera tenga (Ixora acuminata, Roxb)*, are put into water, and the solution boiled. Then a string is tied to the now almost finished article, and it is dipped into the boiling liquid and kept there a minute or two. When taken out the ornament is rubbed with a cloth, and the enamelling process is complete. Some goldsmiths employ two processes for colouring the gold. The first is known as *Bar rangan*. In this the entire ornament is covered with a thick solution of sulphate of copper, salt and water, and then heated under the cylinder till the salts cease effervescing. If this process is insufficient the second process known as *Panirangan* is employed. This consists in boiling the ornament for a minute or two in weak solution of sulphur and water.

Iron-smelting is carried on at many places in the Khasi and Jaintia Hills The ore is found in large quantities at Nongkren and Nuspoong, where the mines are the property of private persons. It is usually mixed up in a state of fine division with a reddish brown sand which occurs in mounds or small hills at the above mentioned places. For the information of those who are interested in the Assamese method of smelting and manufacture of iron, we refer them to the original notes. These notes will form the basis of regular treatises on rural economy, the great desideratum of India. The other local Governments might very well imitate the example of Assam.

Of the communications read before the December meeting of the Agri-Horticultural Society of India, those on Nargessar (Mesua ferrea) and insect pests of India are invested with economic interest. Mr Paterson, Moenglas Tea Association, Dam-Dim, mentions that the seeds of Mesua ferrea (Nargessar) are so oleaginous that they are used by natives instead of a lamp, for when merely shelled and dried they burn with a bright flame. The fact of seeds yielding an oil has been long known to writers on Indian Products, for Nargessar oil is used as an embrocation by the Hindus in case of rheumatism. A sample of the oil was presented to the Society by Mr C A. Cantor in 1851; he stated that 24 seers of the seed yielded 13 seers of the kernel, 6¼ seers of oil, and 4¾ seers of cake. That the natives burn the dried seed does not appear to have been noted by any previous writers.

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An interesting correspondence under the heading of Insect Pests of India was recently published in the *Journal* of the Society of Arts, at the request of the Secretary of State for India. The following, extract from Surgeon-General Edward Balfour's letter to the Secretary of State for India, will convey an idea of the purport of the correspondence :—" Although every year, to some extent, and from time to time largely, losses occur there from the pests which attack agricultural produce, India has hitherto been remiss in this matter, contenting itself with reference as to individual insects or blights to such persons as were thought likely to be able to give information. But the subject is of far too great importance to Agricultural India to be left to be treated in so casual a manner, and the special knowledge now available might be utilised to describe the insects which injure the agricultural, horticultural and forest produce of India, suggesting means of preventing, and remedies for the same." Miss Ormerod, who in England annually reports on the insects injurious to food crops, forest trees, and fruits, and the prevention of insect ravages, in writing to Surgeon-General Balfour, warmly approves of his suggestion, and remarks:—" The information that is needed could be given by plain and simple putting down by various persons of what they themselves have observed, and one man notices, perhaps, how deep the grubs go; another how long they live; and so by collating the facts, we get to know the whole history of habits, which is what is needed to work on. It may take a few years to get the whole life history of the insects, but we soon get in the way mentioned above (on which plan my own reports are formed) to

learn the main points, and then all observers are requested to find the missing part of the history."

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As far back as March 1883, the Government of India recorded a resolution directing all local Governments and Administrations to improve the staff entertained in each Province to supervise the village records. Since then replies have been received from the latter that arrangements have now been made in all temporarily-settled Provinces for the careful selection of candidates with special reference to their fitness for the duties to be performed by them and for their adequate remuneration. In the Presidency of Madras, the post of Revenue Inspectors is now to be included in the schedule of appointments, service in which is held to quality for a Tahsildarship. In the United Provinces, the Board of Revenue has undertaken to see that the claims of Kanungos to promotion are borne in mind. In the Punjab, the Government have issued instructions which will tend greatly to increase the number of the Assistant Tahsildars required to fill Kanungoships or similar appointments in the Settlement Department. The prospect thus offered of rising to higher appointments will serve as an incentive to better and more honest work.

* * *

The capital outlay on irrigation works, in the Punjab, exclusive of contributions by Native States for the construction of the Sirhind Canal, amounted at the close of the year 1884-85 to Rs 5,30,47,419 ; of which amount Rs 2,79,59,329 represent the capital cost of works practically complete and in full operation, and the balance the capital expenditure on works, either under construction or as yet barely in operation, such as the Sirhind and Swat River canals. The gross revenue assessed during the year amounted to Rs 39,76,484, and working expenses of all kinds to Rs 21,13,615, having a net assessed revenue of Rs 18,62,869, or 3·51 per cent on the capital outlay to end of the year. The canals in full work however yielded a net return of 6·91 per cent. The surplus of net receipt over interest charges up to the end of the year amounted to Rs 2,19,60,859.

During the past eight months of the year 1884-85, the total amount of imports including treasure was Rs 45,84,80.067 and exports Rs 51,31,17 219, the excess of export over imports being Rs 5,46,37,152. Amongst the articles of import, it is curious to notice about 19½ lakh rupees worth of tea, of which more then 16 lakhs came from China. We should never have thought that such a large tea exporting country as India would import such a large quantity of tea from foreign countries. The import of coffee and cocoanuts is also well worth noting. It will interest many of our readers to note that during the past eight months, we imported matches worth about 12 lakhs, perfumery about 3½ lakhs, and soaps of all kinds about 6¾ lakhs. Under the head of books and printed matter, our demand seems to be steadily increasing. The visit of Mr Wardle to India to stimulate and encourage her silk industry has turned the attention of all silk-growers and manufacturers towards that direction. A comparison therefore of the export and import of raw silk during the past eight months is invested with peculiar importance. During the said period, our export of raw silk amounted to Rs 13,56,722, while our import stood at Rs 51,95,318, that is nearly, four times the value of the export. Besides a comparison of the figures of the corresponding period of the last two years, shows that the value of raw silk exported is rapidly diminishing. From Rs. 38,62,312,. the value of raw silk exported in 1883, it fell to Rs 24,96,591 in 1884 and the figures for this year have already been given above. The attempt to revive the silk-industry of India has not been begun a day too soon.

* * *

Mr Wardle F. C. S., the celebrated silk-dyer of Leek in England, is amongst us. He has come out at the invitation of the Government of India to prepare for the forthcoming Indo colonial Exhibition in London, such a collection of silks and information as might tend to awaken the attention of manufacturers. The causes which have led to the ruin of the trade in Indian silk are according to him, defective *reeling* and defective winding after the silk had been reeled After lengthened microscopical and other examinations of the silk of Bengal which is the principal seat of growth of silk in India, he has convinced himself that the fault is not in the fibre itself, for in comparison even with Italian silk, its structure leaves nothing to be desired. He advocates the introduction into Bengal of the Italian reeling machine—*Tavelette consono*—a machine very simple in construction and easy to work. The Government of India has undertaken to engrave the machine and we hope erelong to place before our readers a copy of the same. That there is ample scope for the development of silk industry

may be inferred from the fact that for the 10 years, ending 1883, England has been purchasing manufactured silk from countries in Europe to the extent of above 11 million lbs. annually, and that whilst during that period Europe has been annually consisting 6 million lbs. grown in Italy, 1½ million lbs. grown in France, 7 million pounds grown in China, 3 million lbs. grown in Japan, India can only show a growth of one million pounds, and last year it had sunk to only 457,600 lbs.

Mr Wardlle seems to be very sanguine about the development of the trade in Tussur silk of India. He was engaged in attempts in this direction for some years past. He could not induce the manufacturers in England to utilise Tussur and had to visit Germany to have his ideas of Tussur plush first carried out. In 1878, at the Paris Exhibition, the French manufacturers were very much struck with the Indian Tussur and were ready to give orders for almost any amount. They were told, however, that such silk was not yet in the market. He then appealed to India but the Indian manufacturers did not at all respond to his appeal. The field that India chose to neglect, China took up in right earnest and the manufacturers got what they wanted. But although China has got the start of us in the race, India has now begun in the right direction. China began by sending out the worst possible she could get, India has begun by sending out her best reeling. There are now several filatures working in tussur silk and producing very good tussur. But besides tussur, there are two other silks which deserve special attention, *viz.*, the *Erea* and the *moogh* silk of Assam. The last seems to be more promising than the first which has to be carded and spun.

On the authority of the filatures he visited, Mr. Wardle has made certain statements relating to the rents of mulberry lands. He is reported to have said that "the rent exacted by the Zemindars from the ryots who cultivate the mulberry plant is excessive. In the neighbourhood of Berhampore, the rent is now Rs 12 to 14, in Maldah Rs 16. It is the Native Zemindars who exact such very high rents and not the European." We have his authority to state that his speech was not very accurately reported. He is not responsible for some of the discrepancies that appear in it. With larger experience and better knowledge of the native Indian ryots and Zemindars, he will find that his opinion will have to be greatly modified. He will see that Mr. Keswick was right when he pointed out that "like anything else land must be governed by the laws of supply and demand." The Zemindars do allow their lands to remain fallow rather than lower their rents but this is resorted to in rare cases and only for a short time. They know their interests too well to require a lesson in land-letting from a foreigner.

With reference to Government help in the revival of the silk industry of India, it is no doubt the duty of the Government to see the industry stimulated and fostered, but the movement for it should first come from the people themselves before Government would undertake the task. For this reason the suggestion of Mr. Wardle to begin a careful and complete statistics of the cultivation and growth of silk and to feel the actual position of the economy of the production, is well worth serious consideration from the Government. Fuller and more accurate information should always proceed any attempts at improvement. We are glad to learn that steps have already been taken to have the natural history of all silk-worms both domesticated and wild, thoroughly investigated, and, if we are rightly informed, Mr Wood-Mason, the able naturalist attached to the Indian Museum, has undertaken the work.

Amongst the various topics dwelt upon in the annual Report of the Bombay Chamber of Commerce, the remarks on the extent and nature of the cultivation and trade in wheat and cotton will be read with great interest. (See Bombay Gazette of January 15, pages 8 to 9). The Indian Wheat harvest of last season was probably the largest ever gathered, the weather having been exceptionally favourable throughout. In an interesting memorandum published by the Agricultural Department of the Government of India in April last, it is estimated that the whole area cultivated was 27,620,223 acres which gave an yield of 7,713,096 tons, against normal figures of 26,000,000 acres and 7,135,000 tons respectively. Although the markets in Europe—with the exception of a short period activity in the spring owing to apprehensions of war with Russia—have been most depressed, the low rates of freight ruling during the greater part of the year and the important decline in sterling exchange, have enabled a

large export business to go forward. From Bombay alone 611,218 tons having been shipped in the twelve months ending 31st December last, as against 410,655 tons in 1884, when a much higher level of prices prevailed in Europe. The growing crop does not promise quite so favourably, but as the stocks of grain in the country are still liberal, the probabilities are that the shipments in 1886 will also attain large figures.

Following in the footsteps of their predecessors in office, the Committee of the Chamber of Commerce have given the important question of the improvement in the cultivation of wheat in India a leading share of their time and attention during the year. In cordial co-operation with Mr. E. C. Ozanne, C. S., the Director of Agriculture in the Bombay Presidency, who has the same object thoroughly at heart, every assistance in the way of procuring seed, reporting on the quality of samples, and furnishing information, has been rendered to Government servants, the officials of Native States, and others interested; and although it may not be possible as yet to point to any visible results from this measure, there can be no doubt that ultimately they must tend to materially assist the development of what, next to cotton, has already become the most important branch of Bombay export trade. Government by a resolution passed on 15th January last, instructed the officers of twelve collectorates in the Presidency to send samples to the Chamber of the different qualities of wheat produced in their districts. In accordance with this the samples were received and submitted to a Special Committee, consisting of Messrs. M. R. Woer, J. Fachiri, L. R. W. Forrest, and W. Lang. These gentlemen carefully went through, examined, graded and priced 109 samples in all, from which they selected the following as most suitable for export :—

Hansia, Sakhadvala...Broach,		Wagra Taluka.
Bakshi ....Poona,		Junar "
Chasia ....Mahikantha,		Katusan "
Red Hard... ....Kaira,		Matur
White Soft .... "		"
Hard Yellow............Nasik,		Dindort
Hard White .... "		"
Banshi .... "		Nasik
Banshi .... "		Niphad
Wajia.....................Panchmahals,		Dohad
Katha........ ....Sorath Prant,		Junagad
Ree Wheat.... ....Belgaum		Paresgad
Daud Khani ......Ahmedabad,		Viramgaum Taluka.
Hard Red ....Dharwar,		Dharwar "

By this time, however, more detailed information had become available of the previous experiments. It was found that the poor returns were not only due to the unsoundness of the seed, but that the change of soil and climate had had an undoubted influence on the quality of the produce, and that the indigenous varieties yielded a better crop than selected samples imported from other places. Under these circumstances, the Director of Agriculture decided to discontinue the general distribution of selected wheat for seed, confining it to Belgaum and Bijapur, where the crop of the previous year had been so poor that the ryots found great difficulty in obtaining good seed, and to Surat, where alone had the previous experiments given a really favourable return. The committee, while agreeing in the main with the conclusions arrived at by the Director of Agriculture, considered that valuable information had been gained from the experiments, and in addressing Government advocated a further trial giving special attention to the suitability of the seed to the localities selected. In the meantime the present season will afford further information, especially from the experimental farms, and with the excellent collection of samples selected by the Chamber to guide him, the Director of Agriculture will be in a position to turn the results of the experiments to good account.

Competent authorities have given it as their opinion that if the Indian product could be brought to market in the same condition in the matter of cleanliness as English Wheat, it would be worth on the average 5 or 7 per cent. more all round. It is not only the loss in weight which has to be taken into account, but to remove the objectionable features, special washing, and cleaning processes have to be adopted in milling, entailing considerable additional expense, and even then a large admixture of Indian Wheat can generally be detected in the flour. It is indeed by no means an outside estimate to say that cost of transport to the seaboard in a large export season like the present is actually incurred on 80 000 tons of useless dirt and foreign matter. It is manifest, therefore, that if this could be obviated one of the greatest impediments to an increased export trade in Indian Wheat would at once be removed; and by greater care in preparation it could easily be done. An important step in this direction would be gained if the ryots

could be induced to adopt the use of modern threshing machinery instead of having the Wheat trodden out by bullocks or buffaloes as at present, and the Director of Agriculture showed by practical test this season in the Nasik district how easily and advantageously it would be practicable. The remedy for this evil, however, we believe lies also with those engaged in the trade of wheat.

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The much debated question of the adulteration of Cotton was brought before the Committee again early in the year by a letter from the Bombay Government covering voluminous papers on the subject from the Collector of Khandesh, the Commissioner C. D., and the Director of Agriculture. The two former strongly advocated a return to the Cotton Frauds Act, as, in conjunction with a refusal on the part of merchants to deal in the mixed product, the only means whereby the evil could be suppressed. The Director of Agriculture on the other hand suggested a local enquiry by the Commission to determine the following:—

(1).—As to what kind of Cotton should be grown in Khandesh.

(2).—As to how the Ryots can be induced to sow different varieties of Cotton separately, full scope being given to them to whichever variety they may choose.

(3).—As to whether the Saw-gin is an essential concomitant of the long stapled Dharwari Cotton.

Any attempt at legislation, the committee, felt convinced, would prove futile and inoperative, and, in their opinion, the true remedy must originate with the consumers and gradually work backwards.

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The Government have for some time past been anxious to obtain supplies of khaki-coloured Cotton cloth for the clothing of the troops, which would be a fast colour and not liable to wash into different shades the objection attaching to all khaki-dyes hitherto tried. To this end the Government of India have been endeavouring to promote the cultivation of Nankin Cotton, which is self-coloured of the required shade, and are offering the comparatively high price of 4 annas per pound of clean Cotton for it. The Director of Agriculture in the Bombay Presidency sent for the report of the Chamber in July last a small sample of this Cotton produced in the Ahmednuggur district. Committee, having carefully examined it, gave it as their opinion that the Cotton had nothing but its special colour to recommend it, being short and irregular in staple and most unprofitable stuff to work. They further strongly advised that the cultivation of the description should be confined to the places where it is indigenous, as there would be great danger of its hybridising with the local varieties, to their detriment, if introduced largely into this Presidency. This opinion quite coincided with the Director's own views formed after careful experiments made in cultivating the seed under various conditons and he reported to Government accordingly.

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Our readers may remember that in the article on ensilage published in a previous number of this Gazette, mention was made that certain feeding experiments with ensilage were then being conducted by the celebrated scientist and practical farmer, Sir J. B. Lawes of England, in his well-known experimental farm of Rothamsted. The results of these experiments have now been made public. Two sets of feeding experiments were made—one with a number of fattening bullocks, and the other with milch cows Very elaborate tables giving the weekly weights of milk yielded by each of the 40 cows during the whole course of the experiments, and for the three previous weeks, and also the exact quantities of food given each week, &c., are contained in the original papers, but the broad results can alone be given here. The principle of the first set of experiments was to feed half the cows on weighed rations of oil-cake, bran, hay and straw chaff, and mangels; and with the other half to try the effect of replacing the 80 or 90 lbs. of mangels given daily, by 50 lbs. of red clover silage, estimated to contain an equal quantity of dry food. This programme was adhered to as nearly as the nature of the experiment allowed, with the following results:—Over the whole experimental period of 13 weeks the average yield of milk of the cows receiving clover silage was 25 lbs. 12 ozs. per day, against 27 lbs. 5 ozs. yielded by the cows receiving mangels. This corresponds with a difference over the whole period of 14 gallons per head, or of 281 gallons in the lot of 20 cows, in favour of those receiving mangels. The cows fed on the clover silage drank an average of 1¾ gallons more water per head per day than those fed on the more succulent mangels.

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On the other hand, all the silage-fed cows who remained to the end of the experiment had increased in weight, whilst the mangle-fed cows had on the average lost weight. At the close of the 13 weeks

(March 14, 1885), the experiment was varied by the gradual substitution of meadow-grass silage for clover silage—the rations of the mangel-fed cows remaining the same. For the first week ¼ grass silage and ¾ clover silage was given; then half and half for a week; and for the next four weeks grass silage only. One effect of this change was that some of the food supplied to the silage fed cows remained unconsumed; so that at first less chaff had to be given, then less silage, and, finally, a little mangel had to be given instead of some of the chaff and silage to all of the cows in this lot. The grass silage, it will be noted, contained a larger percentage of dry matter, and especially of woody fibre, than the clover silage. During the six weeks of the experiment, the grass silage-fed cows gave an average of 2 lbs. instead of 3¾ lbs. less milk per head per day than the mangel-fed cows, and they fell off in yield towards the end of the experiment less than the mangel-fed cows. The silage-fed cows in this experiment *lost* weight on the average, whilst the mangle-fed cows *gained* weight. Probably the improved relative yield of milk in the grass silage-fed cows was obtained at the expense of the live weight stored up during the previous experimental ration of clover silage. Regular analyses of the milk were made during the course of these experiments, and from the results it appears that the milk of the mangel-fed cows contained on an average 12·27 per cent. of the total solids, of which 3·45 was butter fat; the milk of the silage-fed cows contained 11·93 per cent. of total solids, of which 3·24 was butter fat.

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As regards the experiment with fatting oxen, ten of these animals were carefully selected, and on the 19th of December weighed and divided into two lots—as nearly alike as possible in every respect. One lot of five was to receive 65lbs. clover silage per head per day; and the other lot 12lbs. of clover-hay and 50 lbs. of swedes, estimated to contain together as much dry food as the 65lbs. clovers silage. In addition to this, both lots received 6lbs. oil-cake and 4½lbs. barley meal per head per day. The experiment lasted 16 weeks and two days, and th beasts were weighed at the beginning and end, and at two intermediate periods. The total quantity of dry substance consumed by each lot was, on an average, 24—25 lbs. per head per day, and the quantity of contained nitrogen was practically the same in the two cases.

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Taking the result for the whole period—whether we compare the total increase in weight, the average increase per head, the increase per head per week, or per 1000lbs. live weight per week—there is a very close agreement between the two lots, the one receiving clover silage, and the other very nearly the same quantity of dry substance in clover-hay, chaff, and swedes. The silage has slightly the advantage, but the difference is not more than might be expected in two lots of oxen fed on precisely the same food. Both lots did remarkably well, the silage-fed oxen giving an average increase of rather more, the others of rather less then 1½ per cent. of their live weight per week.

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The experiments with English wheat which were made last year in various parts of Madras do not appear to have been by any means successful. The districts where the seed was sown were principally those of the Neilgherries, Bellary, Salem, and Madura, and the reports recieved from the Collectors of all these districts state that in some cases it did not germinate at all, while the plant in others died off, soon after sprouting, from either drought or excessive rain. Mr. Price, the Director of Agriculture in the Madras Presidency, is, however, of opinion that it has not been conculsively shown by these experiments that English wheat will not succeed in India, as there may have been either unskilful cultivation or want of care. He considers that, instead of sending the wheat to the Collectors, it will be better to make arrangements directly for careful cultivation, and he suggests that some more seed should be procured from England the Panjab. The local Government has agreed to this, and has directed that the new trials should be made in the Neilgherries in suitable localities, to be conducted through the *badagas* under proper supervision.

1. List of Agricultural Implements of the Bombay Presidency: From the Director of Agriculture, Bombay.
2. Trade and Navigation Report of British India for November 1885: From Government of India.
3. Proceedings of the Agri-Horticultural Society of India for December 1885: From the Secretary.
4. Notes on Assam Manufactures: From Assam Government.
5. Memoranda on the Prospects of Rice-crop in British Burma, fourth or November forecast of the Cotton and Til crops of the North-Western Provinces and Oudh, Cotton crop in the Bombay Presidency, Wheat crop in the Bombay Presidency, Wheat crop in the Berars, and Wheat and Oil-seed crops of the North-Western Provinces and Oudh: From Government of India.
6. The Hindu: From Manager.
7. The Bangalore Spectator: From Manager.
8. The Native Opinion: From Manager.
9. The Hindu Patriot: From Editor.
10. The British Burma Gazette: From British Burma Govt.

THE DUTIES OF AN AGRICULTURAL DEPARTMENT.

IN our last issue we tried to prove that agricultural enquiry, that is, collection of agricultural and economic information should take precedence over all other questions relating to Indian agriculture. We insisted therein that the first efforts of any agricultural department ought to be directed towards securing continuous and comprehensive information on every one of its manifold details. A limited staff of agricultural officers scattered over the country is quite out of proportion to the magnitude of the task indicated above. We do not mean, however, to deprecate their well-meant but at best desultory efforts; but we venture to believe that the first and foremost duty of an agricultural department will have remained unfulfilled until it has been sustained by an organized machinery established on a wider and permanent basis.

It is easy to give a brief outline of the way in which such a machinery may be formed and maintained, if the intention of the Bengal Government to introduce a cadastral survey is carried out. For in that case the records furnished by the cadastral survey will serve as a basis on which the agricultural department will proceed to maintain them up to date and this certainly is the primary duty of the department on which we so strongly insisted in the last number of the Gazette.

Let us take the present divisions of a province into divisions, districts, subdivisions or circles, and villages. Taking the village area which may consist of one, two or more villages for our unit area of enquiry, we shall have presiding over it the rural recorder whose business may be briefly designated as the collection of all necessary information affecting the agricultural and economic interests of the locality. He will know from the records of the cadastral survey the extent and owner of each particular field within his jurisdiction and as the year slowly advances from seedtime to harvest, he will record the area under each crop and finally estimate its out-turn. The total acreage of each crop and its total produce over the whole village area will be thereby easily made out. The rural recorder will also from time to time report as to the state of the weather and how it happens to affect each particular crop. As the prospects of crops in India are intimately connected with the amount and distribution of rainfall which vary almost from village to village, each rural recorder should be provided with at least one rain-guage fixed in a suitable place within the village area under his jurisdiction and instructed in the use of it. He will note from day to day the quantity of rain that falls and a comparison of it with the corresponding falls of the previous four or five years will serve as a very good index to determine the crop prospects of any particular season.

If one thing more than another demands our special attention, it is the state of our cattle and, in a lesser degree, of horses, sheep, goats, asses and mules. While both Government and the people cry out alarm at the prospect of a district being blasted over by drought, they look on passively when a plague sweeps away millions of our working and milking cattle. It is high time therefore that Government should institute a census to determine the number and density of the animal populations; such a census to be of any practical value should be periodically repeated and when their results will be compared, the fluctuations of the respective populations will be apparent. As cattle form an integral part of the material wealth of the rural classes, any fluctuation in their number will serve as a good index to the prosperity or otherwise of the country. An additional duty of the rural recorder will be to make an inventory of the different classes of cattle, horses, sheep etc. within the village area and to note and report how they may be affected by plagues or other untoward circumstances.

Besides subjects of a purely agricultural nature, all questions affecting the rural economy of the locality would occupy the attention of the village agent, a few such among others being the variation in the market price of staple articles and the condition of any local trade or industry.

Next to the rural recorder will rank the circle inspector whose function will be mainly confined to the collation of the reports of the rural recorders and their verification in cases of doubt or difficulty. The circle officers will also from time to time inspect the village areas within their jurisdiction inorder to check the work of the recorders and help or instruct them in the proper discharge of their duties. While the mere collection of facts and figures and the putting them into a prescribed form may be entrusted to the circle inspectors and village recorders, the task of the higher officials posted at the several districts and divisions of a province will be one of general supervision. A thorough and efficient working of the department would depend wholly on the supervision exercised by the higher officials over the work of the subordinate staff. It would be idle to suppose that the field to field inspection will form a regular part of the work of the former, for then it would

cultivation, the cultivator has learnt by experience that a particular variety is specially adapted to a particular class of soil; that while stiff clay has its special variety, sandy loam has its own; and that a change from one to the other has to be made with special care and under particular circumstances.

It is a matter of every day experience that cereals are liable to fall off from year to year in most soils and want renewing. A variety of paddy grown on a particular plot of land may yield a very havy crop for a year or two, but the yield falls off perceptibly later on, though the reasons for the fall off are not very well understood. The same land if cropped with another variety not unusually gives a larger outturn. You will see that in a village a particular variety becomes the general favourite of the villagers for a year or two, that it is grown in almost every second plot of land you come across, but, sooner or later, another variety crops up and displaces the old favourite. This has been so for ages and it may safely be presumed that the innumerable varieties of rice that we see at the present day, have gradually sprung up in course of selection and elimination induced by sorrounding circumstances. The finer varieties of paddy which are grown and dressed for the table of the well-to-do and rich have an invariable tendency to become coarse, if they be grown continuously for a few years on rich clay soils and, if once rendered coarse, it is not very easy to bring them back to their original condition. The growers of finer varieties therefore pay particular attention to the class of lands on which to grow them. Instances might be multiplied if required to show that the deterioration or improvement of agricultural plants depends on a variety of circumstances, a clear insight into which is essentially necessary inorder to bring about a wholesome change in the systems of agriculture which have got stereotyped in India.

Agricultural plants as we have indicated above have an inherent tendency to vary, the sorrounding circumstances and selection artificial or natural helping materially to develope that tendency. "Professor Buckman of England in treating the seed of wild oat (*avena fatua*) as a crop plant, selected the largest and heaviest seeds for carrying on his experiments. In course of time very respectable oats were obtained, weighing nearly 40 lb per bushel; whereas the wild oat, left to itself, was only 15 to 20 lb. This proved the importance of selection and that it is the parent of the cultivated oat." An enquiry therefore into the origin of new varieties of cereals such as rice, wheat, oat and barley like that of all other agricultural plants is invested with great interest for the agriculturists.

Crossing or hybridzation, natural sports or freaks, and introduction of foreign seeds are the three main sources of obtaining new varieties. As the process of crossing may not be known to some of our readers, and a knowledge of it may be useful to many, Mr. Shirreff's practical description of it may be quoted with advantage:—

"The crossing of cereals consists in fecundating the stigma of one variety with the pollen of another; and in the case of wheat, there is so little difficulty in the process that it may be successfully carried out by persons unacquainted with botany, after getting one or two lessons. Commence operations by shortening the ear of the seed, or female breeder, a day or two after being clear of the sheath, remove every alternate spikelet, and leave only two outside capsules on a notch. An ear so prepared may consist of four or six notches, with eight or twelve capsules; and the mutilations which the ear has undergone will facilitate after manipulations, and prevent upper florets from shedding their pollen on the florets under operation. Having proceeded so far with the seed parent, bring forward an ear or two of the pollen parent about the same stage of forwardness. Then open the chaff scales of the female breeder, and having removed the anther out of the capsule, replace them with anthers taken from the male breeder, then close the chaff-scales by a slight pressure of the fingers. In removing the anthers of the seed parent, care ought to be taken not to break them, as their pollen may fall upon the stigma, and in such a care the resulting seed may not produce a hybrid plant Little nicety is, however, required in changing the anthers of the pollen parent, as the pollen dust retains its fertilising properties for a considerable period, and the bruising of the anthers is not unfavourable to fecundation. The ear operated upon is then fixed to a stake, and protected by a wire-gauze."

The attempts of Messrs. Carter & Co, the great Seedsmen in London, at procuring new varieties of wheat and their promising results have been duly noted in the eighth number of the Gazette. "By crossing some of the finest kinds which have been hitherto produced by selection, entirely new sorts have developed. The experimental farm of the company is situated at Forest Hill, where one row of the hybrid is sown between a row of its parents on either side; the improvement and development of the new cross being visible to the eye. In one instance, a short strawed, velvet chaffed wheat was crossed with a large beared American variety. The result was a medium sized plant, about a foot taller than the female plant, with

minute awns on the apex of the chaff of each grain. This variety seems to have disgusted the sparrows, and it has accordingly been christened 'bird proof.' Red and white wheat have also been crossed, with a view to securing the advantages of both breeds; and it is expected that the offspring will be much appreciated by the importers. It ripens fourteen days before either of the parent plants. Among other peculiarities, the hybrids in many cases have firm set grains which are not easily shaken out of the ear—an advantage to cultivators in the windy uplands 'golden with old corn.' Every experiment has been marked by the vigor and productiveness of the crossed varieties, as compared with either of their parents. One plant bore sixty ears, averaging about fifty well formed grains to the ear; or three thousand grains from a single seed."

From the above extract and a perusal of Mr. Shirreff's description it is obvious that crossing requires an amount of skill, nicety and foresight hardly to be expected from our usual run of unlettered agriculturist, though there seems to be little doubt that crossing followed up by selection, will bring out some prolific strains which will benefit the cultivator.

Great deal however can be done by ordinary farmers in the way of improving existing varieties or bringing forth new ones by cultivating from natural crosses. In a field of wheat or paddy, it is not at all uncommon to come across an unusually long ear with seeds plumper, better filled and larger in number. If that particular ear be picked out from among the rest and treated under garden culture, it may lead in the course of a few years to form a new and more improved variety than the one from which it originally sprung. It takes no doubt a long time to establish the character of the new variety thus obtained, but the skill and perseverance required in so doing are more than compensated when the improved strain is established. The first attempt of a cultivator to introduce a more prolific strain may not be crowned with success, but practice will no doubt teach him the best means to secure the end. Some may be naturally more acute in finding out the latent good qualities of natural sports and thus happy in the selection of promising strains. Some instances of happy selection may be quoted here for the information of our readers:—"It is forty years, in this the month of October, since Mr. Banham, in overlooking his reapers, saw an ear of wheat somewhat different from those around, and he took it home and dibbled each grain by itself in his garden. It was a full ear, and equally developed from top to bottom, and before harvest it was threaded to preserve it from birds. The straw was stiff and strong; a new variety it certainly proved to be, and was well worth the attention and care bestowed upon it. In two years a small field was sown with it, and it yielded larger crops than any other variety. By selecting every second, third, or fourth year, according to the quality of the grain, Mr. Banham has succeeded in keeping up the strain of this prolific wheat, and as he used his own threshing machine and grows no other wheat, it has been kept perfectly pure. It produces plump kernels, square equable ear, and long, clean, and stiff straw. It is also a hardy wheat, which is well evinced at the great Experimental Farm at Rothamsted, where it has been tested against more than twenty other varieties for many years.*"

"Major Hallett has also been distinguished in this line of improvement for many years. He chooses a promising ear of wheat or other grain, selects a single grain from that ear, and restarts it in each succeeding year. In this way he has improved several kinds of wheat, namely, the Original Red, Hunter's White Wheat, Victoria White, and Golden Drop. He has also brought out Chevalier Barley, White Tartarian and Black Tartarian Oats, and as a protection and a trade mark, he applies the word "Pedigree" to them all.

"The Potatoe Oat is still well known. It was picked up by a servant of Mr. Jackson's of Arkleby, Cumberland in 1778, and after it came into field culture it nearly supplanted the Poland and Tartarian. The Sandy Oat was picked up by Sandy Thomson, a boy on the farm of Noth, in the parish of Rhynie Aberdeenshire, in 1824, and it proves hardy, well strawed, and not liable to shed. There is no barley which has obtained a more extended cultivation than the Chevalier. Dr. Chevalier, parish of Debenham, Suffolk, seeing an ear of good appearance in his field, preserved it, and subjected it to garden culture. This was in 1820, and he was able to plant half an acre with the increase in 1825. The Hopeton Wheat was found and propagated by Mr. Shirreff in 1824. It consisted of a single ear, containing 102 grains or kernels, three of which dropped off, and the remaining 99 were carefully multiplied. To Mr. Shirreff the wheat-growing farmer is also indebted for Mungoswell Wheat, which was discovered a few years anterior to the last named. A green spreading plant attracted his notice in the spring—the crop then looking miserable from the severity of the winter. He took measures to invigorate its growth by weeding and manuring, and in harvest sixty-three ears were gathered from it, which numbered 2473 grains, and which were dibbled at wide intervals for the

succeeding crop. For the two following years the produce accumulated, and the fourth harvest of the original plant amounted to 42 quarters of grain fit for seed. * "

Many more instances might be adduced if required to show how a farmer could do good service to himself and to his country by some care and attention in cultivating promising sports and following it up by selection. A stray ear of cereals or of any other crop has to be tested for a few years, to determine whether for constancy, quality and polificness, it is worth general cultivation. The instances which we have added above are all drawn from British agriculture. But an example might be given of similar care exercised by some of our home farmers who grow some variety of paddy for their own use. In order to keep the varieties true to their sorts, the sheaves of paddy are carefully handpicked before they are threshed, the inferior grains are thereby eliminated and the superior ones reserved for the next year's seeding. This brings us naturally to the question of care to be bestowed on the selection of seeds, the importance of which is not unknown to our cultivators, but they have very limited means at their disposal to carry out in practice what they know very well in theory. The various agricultural departments of India with the laudable object of improving indigenous agricultural plants, have been we know trying to introduce foreign seeds. But we would urge upon them the necessity of not only informing our ryots as to the importance of improving their agricultural plants but also devising some practical means for bringing home the truth of those information, by taking initiative in the matter.

We refer our readers to an extract which we give in another column under the head of "Continental Seed Control Stations" from which it will be evident that, among other things, attention to the proper method of selecting seeds has a very great bearing on the question of improvement of agricultural plants.

A NEW OIL-MILL.

THE extraction of oil is one of the most important of Indian industries, affording occupation in almost every village to a few or many, to meet the constant demand for a necessary of life throughout the country at large. It would appear that in Bengal, Southern India, and Ceylon the industry is in a much more advanced state, and far more developed, than in Western India, and from a prospectus just received of the proposed Barsee Oil Company, it would appear that the subject is attracting the attention of capitalists in Bombay. This undertaking is the first of its kind in that part of India, and for the information of capitalists elsewhere, we many add that a capital of only Rs. 60,000 is all that is required to ensure speculators a remunerative return on their outlay in this direction. This return is enhanced and further assured in those localities where competition can be shut out by reserving the exclusive right to the best appliance, which, in this case, is considered to be "Drewitt's Patent Rotary Oil Mill."

As no less than *Seventy* factories are at work in and around Calcutta on the "Rotary System," which is superseding other methods of expressing oil from seeds and nuts very rapidly, a descriptive account of the construction of this Mill, and of the method of working, may not be devoid of interest or unacceptable to our readers. But before doing so, we purpose entering into some general considerations in connection with a product which not only plays an important part in the Indian household but also in the manufactures and railways of this and other countries. In the first place we should point out that the export of Indian oils is not equal to the demand of the foreign markets, and, on economic grounds, we are averse to the present large shipments of raw material—seeds and nuts—from our ports for outside manipulation and blending. These operations aid in underselling the *pure* Indian oils abroad, and in depriving the Indian soil of a valuable fertiliser in the refuse or oil-cake, which goes to enrich alien lands to the detriment of Indian

Before describing the Drewett Mill, which is really the native *ghani* system elaborated, we will offer a few remarks of general interest. These are best afforded by the following items relative to a large oil-mill in the Madras Presidency, which have been kindly placed at our disposal in connection with this article. The *modus operandi* of the "*cold drawn process*," as there carried out, includes,—in the case of *castor*,—the sifting of the seed, and then husking the same in hopper machines with horizontal rollers, worked by hand labour. Next, after separating by winnowing the shell from kernel, the latter is bagged in gunny wrappers, the packages being suited in size to the vertical plates between which they are strung on the shaft of the Mill. This latter appliance is the common *press* used for seed-oils in large establishments in other

* See Transactions of the Highland and Agricultural Society of Scotland, Vol. XVII. p. 205.

parts of India. The plates are forced together by pressure induced by man-power applied to capstan bars moving in a vertical plane on the shaft end. The exuding product from the oil-bags between plates on the shaft, is collected, boiled, and filtered—after which it is canned or barrelled for export.

The oil expressing operations at or near Allahabad, carried on by both the East Indian Railway and private firms, are much after the manner here described. This is what is usually known as the European system, which is asserted to be unsuited to India, and yields a smaller outturn than the common native mills in proportion to the seed employed. It is further declared as a well known fact to those interested in oil-pressing, that those primitive native wooden oil-mills, worked by bullock power, can extract up to 6 per cent. of oil from the refuse or exhausted oil-cake made by the European mills. Mr. Drewitt has therefore taken advantage of this circumstance, and has designed a mill which specially combines the advantages of the Indian and European systems of seed crushing. It is instructive to follow his reasons and objects which explain the why and the wherefore of his invention.

He says that the difference in yield arises from the seeds or nuts being subjected in the native mills to enormous crushing and grinding pressure in detail, which is very much greater than that exerted in the European mills, the operations in the former case allowing the oil to escape unimpeded, whereas in the latter the pressure being applied to the seeds or nuts in bulk, the oil cannot readily escape because of the great mass of the seed-bags and the heavy wrappers used informing them. There is common sense on this side of Mr. Drewitt's argument. The native mills labor under a disadvantage in this competition from the previous non-maceration of the seed as is done under the European system; and further more the outturn is low because the *ghani* being driven by bullock power, no increase of the animal's pace is possible. The gist of Mr. Drewitt's improvement and Patent may be epitomised in his own words :—

"The unwieldy and repulsive looking wooden *ghani* has now been superseded by an iron-mill which may be used for all classes of seeds or nuts, and which while retaining all the good points of the native system of crushing, is capable of being driven at four times its speed, and under four times the pressure the wooden mill could bear, occupying at the same time one-tenth its space. And with the iron mill it has been found possible to take advantage of all the European improvements and modes of working, such as macerating and heating the seed by steam."

But it should not be forgotten that this is only applicable to an elaborate factory system provided with all the accessories of European art, and it ignores the cottage system by which the poor ryot with his cattle can in his own primitive way—using the stump of a tree as a mortar and a branch as a pestle—produce results which, to himself at least, are eminently satisfactory.

Likewise, it is only fair to mention that the comparative failure of European systems of seed-crushing in this country are as much due to the heavy expenses entailed by a staff of skilled operatives, as to the inherent defects in the processes of manipulation.

Mr. Drewitt's mill is not within the reach of *all*. The desideratum for India, in the matter of oil-presses, is something after the "Behea Sugar-cane Mill" by Messrs Mylne and Thomson. We concede, however, that Mr. Drewitt's device is capable of useful and profitable utilisation by joint-stock concerns, and are within the means of most of our landed proprietary. He has fully grasped an important principle in oil extraction when he says that "steam heat being applied to the mortar in which the seeds are being crushed has the effect of causing the oil to separate freely from the seeds, the heat being applied at just the right time, and never exceeding 200 degrees Fahrenheit, cannot therefore injure the oil in colour or smell."

This is farther elucidated in the following excerpt, which gives a further insight into the Drewitt appliance :—

The advantage derivable from the application of heat to the crushed seeds for the purpose of facilitating the separation of the oil from the seeds, enabling the work to be performed more rapidly and increasing the yield of oil, is well understood all over the world. The natives of India use fire or hot stone or irons for the purpose of warming their partly crushed seeds, and until recently, the Europeans followed the same practice. The degree of heat in these substances being an unknown quantity, the system of direct heating by partly scorching or burning the seeds nearest the heated iron or stone, discolours and spoils both the taste and smell of the oil, and thus lowers its value very much; but as the yield of oil is 5 to 8 per cent., more than could be got by the cold process, the practice is very common all over India.

The defects of the direct heat system are quite overcome by the use of hot water or steam heat surrounding the half crushed mass, which was introduced into the English mills some 25 years ago, and is now used in America, Australia and the

whole of Europe. The application of this valuable improvement to the native mills was impossible so long as they were made of wood, but it has now been successfully applied to the iron native mills under Drewitt's patent, in which the steam is confined in a "jacket" surrounding the mortar in which the seed is being crushed, and thus has all the beneficial effect of heating the mass without burning the oil, and also facilitating the work, admitting of twice the work being got from this mill in comparison with others working cold.

The inventor claims that his mill will produce 6 per cent. more oil from a given quantity of seed than can be obtained by any other mill now working. This good effect is accomplished by four causes—*viz.*, the application of hot water or steam to the mortar in the way mentioned above; the provision of a *through* hole in the bottom of the mortar for the escape of the expressed oil and other purposes; the use of a worm and worm-wheel for communicating a rotative motion to the mortar; and the employment of changeable metal-liners for mortar and pestle, by which any kind of seed may be operated on, while saving the wooden portion of the mortar and pestle from wear.

The whole machinery is compact and self contained—that is, *all in one*. The smaller mills turn out 200 lbs of gingelly oil per *diem*, and three such can be driven by one horse-power; but any number of them may be coupled together and driven from an engine at one end, without the aid of belting of any kind. Simplicity is the essence of this appliance; at the same time it offers all the advantages of economy in working; while its freedom from complications renders handling easy—notwithstanding the fact, already mentioned, that it combines the latest accessories of European art. We are, therefore, disposed to accept the "Rotary Oil Mill" as affording the most modern and approved system of working with a corresponding increase in the margin of profits. Our verdict is that the Drewitt mill is a superior machine from every point of view, which excelling all others, is sure to commend itself for wide adoption—subject to the limitations afore stated.

RURAL ECONOMY OF SHAHABAD.

[From the Diary of an Agriculturist]

SANKAR DEHRI.

THE mouza of Sankar Dehri consists of two villages, the larger one of which is called Sankar Dehri and the smaller one Khani. Sankar Dehri is about 7 miles from the pergunnah station of Pero and about a mile from the irrigation canal. Some of the neighbouring villages are Sara, Barkagaon, Bipandi, Amarhua, etc.

The two villages of mouza Sankar Dehri like the rest of this perganah once belonged to Kumar Singh. Originally there was either a great Zemindar living here, or these villages belonged to some man of position; for the remains of a large tank covering about 52 bighas are to be seen to the South of Khani. This tank has its bed now filled up and the high banks much worn off. A great peepul tree and some other trees are now to be seen on its banks.

Villagers.] The villagers of Sankar Dehri are Rajputs, Bhavans, Ahir, Dhubi, Kahar, Nau, etc. Each family cultivates about 10-12 bighas. There is no *patsala* (primary vernacular school) and very few can read or write. Very few have seen any other places besides their own and a few neighbouring villages. The men seem to live almost in an island away from the influence of civilization. They seem however to be well contented with their lot.

Soil.] The soil about this part of the country is peculiar. It is a brownish colored sandy soil, the sand however is not silica but probably an iron silicate. The sand is not friable but possesses many characteristics of a clay soil, becoming very hard in winter, cracks being seen almost in every direction. Much of the water which the ryot with great patience and labor raises from the well and pour over the fields, is I am afraid lost through the cracks. The subsoil is a coarse sand and the depth of the surface soil varies from almost nothing to many feet. In the latter case the soil is rather heavy loam and produces good wheat. This is however the case at a distance from Sankar Dehri. The great want of these villages is water, though there is a canal within a mile to the east; there is however no distributary on the west side of the canal. Formerly these places were watered by the water collected in *khals*, remains of which are to be found in every direction. These *khals* have long remained without repair and therefore been filled up and the banks worn off. These *khals* can however very

easily be made use of in distributing canal water. Thus repaired they will also provide these places with cart-roads of which there is a great want. The ryots now irrigate the lands with water raised from *kaccha* wells which dry up every year. Water is met with at a depth of *duv prosa.* In some places where sand is very close to the surface, water can not be thus obtained or the little that is obtained is not sufficient to work a *mot* (a vessel for raising water) for more than 7 or 8 hours a day. The ryots dig their own wells, each costing about Rs 2, and very laboriously irrigate the land, the success or failure of a crop depending almost entirely on this. A *pucca* well in which two *mots* could work costs about Rs 75.

Crops.] Rice, sugar-cane, wheat, peas and linseed are the principal crops. Formerly very little *rabi* was grown but since 5 or 6 years on the repeated failure of rice, cultivation of wheat etc. has been introduced and in some places good wheat fields are to be seen. The land is however, rice-land and sugar-cane is the crop which brings cash money to the ryot. Barley generally does very badly.

Two kinds of rice are grown here, namely, *Bhadai* and *Khariff.* Of the former *Serha* and *Shati* are two well-known varieties and of the latter *Barati* and *Sirhata.*

Badai.] As soon as the rains set in, the land is ploughed three or four times and the *henga* then applied. When the land gets wet and covered with a little water, seeds are sown broadcast at the rate of half a maund (of 82 lb) per bigha (one-third of an acre). The usual time for sowing is Asarh (about the end of June.) The land is weeded about twice. The crop ripens in Kartic (about October) when it is reaped. As *bhadai* is generally sown in good lands, it is followed by Linseed and other *rabi* crops. Light soil is best suited for *bhadai* rice.

Khariff.] The seed bed or nursery for *khariff* is prepared at about the same time that lands are ploughed for *bhadai* rice, *viz*, at the end of Jaistha (about June.) Seeds are sown on the seed-beds about a month later. To transplant one bigha with seedlings, one maund of seeds is necessary, which is double that required for *bhadai* sowing, since at the time of transplanting 5 or 6 plants are put in the same hole. For the preparation of *khariff* land there is more time and the land is much better worked than that for *bhadai.* Ploughing commences with the rains and when the land gets 4 or 5 ploughings, it is allowed to rest for a few days. It is ploughed again once or twice as the case may be and after applying *henga,* allowed to rest for a day or two. Finally when the land is sufficiently wet, the seedlings are transplanted from the nursery to where they are to grow. This is generally done in Sraban (about August.) It is weeded about twice and requires water till Kartic (about October.) The crop is reaped in November and December. No manure is put in, since there is nothing to be had. The little they have they put in sugar-cane fields. For *khariff* rice *dorus* soil is thought to be the best.

NEWS.

The first (November) forecast of the wheat and oil seed crops of the year 1885-86 in the United Provinces:—The forecast is, as it was last year, based entirely on the bulletins received from selected zamindars in each district. 292 zamindars have reported on the wheat crop, and 288 have reported on the oil seed crops. The question of area will not be touched upon till after the Patwaris have completed their winter tours of their circles, when the areas sown with wheat and oil-seeds will be forthcoming in ordinary course. No extra work of any kind therefore has been or will be required either from Patwaris or Kanungos. The sowing season opened very differently from last year. Last year the rains continued late and the land was so moist that sowings in many places had to be delayed. But a large area was brought under wheat and seeds, including poor outlying lands which in ordinary years are left for pulses or barley. This year the rains in most places ceased in the beginning of September. Dry winds set in and caked the land. When sowing time came on the clods could not be broken up and pulverized and the moisture necessary for germination was very scanty indeed.

The result was (1) a general falling off of the wheat and seed area, the exact extent of which cannot, however, be reported, but which may at the lowest estimate be put at 10 per cent.; (2) an irregular germination of the seed where land was not under high cultivation or not watered before sowing; and (3) irrigation commenced much earlier in many places within a fortnight after sowing. As a set off, however, to these disadvantages the growth of the plant is generally reported much healthier and more vigorous than last year. If the next two months should be ordinarily favourable a larger average outturn may be anticipated than last year. White ants have been reported from a few places where sufficient water could not be had for irrigation. The winter oil-seeds with which this forecast deals are *alsi* (linseed), and *sarson* (mustard) and *lahi* (rapeseed). They are as a rule sown with wheat or barley except in the black soil of Bundelkhand and the rice lands of the Gorakhpur Basti, and Azamgarh districts, where the area under pure linseed comprises as much as 4 to 6 per cent. Of the total cultivated area and in the *tarai* land lying imme-

diately under the Himalayas where pure rapeseed occupies large areas.

The report for November 1885 on the prospects of the Cotton crop of the United Provinces:—The area was obtained in ordinary course from the crop-statements prepared by patwaris and totalled by the kanungos under the rules. Almost the entire cotton crop of the United Provinces is grown within an irregular belt of country running down the Ganges-Jamuna Doab to which Rohilkhand and Bundelkhand are appendage. Oudh and the Benares Division contribute only about 8 per cent. of the total crop. Cotton is rarely grown alone. Its area is generally shared, in varying proportions, by arhar, til, and urd. The til occupies generally a row or two round the outside of the field. The remainder of the field is occupied by arhar and cotton in alternate widths. Economy and shelter to the cotton bolls from the cold winds of November-January are the cultivators' objects in this arrangement. Urd is frequently seen spreading itself all over the available space between the stalks of the main crop.

The total area over which cotton is grown as a mixed crop is 1,592,882 acres. It is grown as the sole crop in 101,609 acres. The entire cotton-growing area may thus, for purposes of comparison, be taken at 1,701,491 acres. The area of 1885 exceeds that of 1884 by 33,681 acres. Taking the normal area at 100, the present year's area stands at 123. Cotton, like cane, is a rent crop and consequently its area has a natural tendency to increase. Til is very sensitive to seasonal influences, particularly at two stages of its growth, first, when very young, and afterwards when flowering. Excessive rain at these stages is very injurious. On the other hand, it grows on almost any land, even the very poorest; and if favoured by the season may yield a handsome return on soil on which scarcely any other produce could be raised. Til is rarely grown as the sole crop except in the Trans-Jumna country and immediately under the Himalayas where holdings are frequently large and rents low.

The Report for November 1885 on the prospects of the *til* crop of the United Provinces:—The total area on which til is grown as a mixed crop is 4,216,290 acres. It is grown as the sole crop in 138,179 acres. The entire til-cropped area may thus, for comparison, be taken at 4,354,469 acres. Til is the great source of oil supply to the people of these provinces. The oil takes the place of *ghi* among the poorer classes. There are therefore few cultivators who do not contrive to get a crop of til somehow out of their land. Hardly a field of juar or cotton is to be seen without its outside rows of til. Hence it is that this crop is found growing in fully one-third of the entire kharif area of the provinces.

Til and Cotton of the United Provinces:—Information under the head of condition has been obtained, as in previous months, solely from the selected zemindars. During November 261 bulletins were received. The sky was clear; there were gentle westerly breezes; there was no rain and no frost. The cotton flowered profusely, the pods burst early, and the fibre was found of good quality, clean, and silky. 'Good' and 'fair' are the verdicts of the reporters from most of the cotton-producing districts. In the Doab, Rohilkhand, Bundelkhand, and in Western Oudh, over four fifths of the crop is reported to have been gathered and cleaning going on briskly. Subsequent to the date of the reports, early in December, rain fell pretty generally all over the provinces. This rain may have done some injury to the final pickings. The Benares Division and Eastern Oudh are late. The variety of cotton chiefly grown in these two sections of the country is commenced even in the end of November. Considerable damage may have been done by the rain in the beginning of December, but the area on which this variety of cotton is grown is insignificant.

The reports of the til crop are more or less encouraging. It had been harvested in fairly good condition. Next comes outturn. Any attempt to estimate the amounts of (clean) cotton and til seed harvested and the quantities available for export is beset with difficulties. The peculiar nature of the crops themselves and of their surroundings as has already been described and their great sensitiveness to variations of season must necessarily introduce a large element of uncertainty into any estimate of aggregate yield. The following estimate is based mainly, on the opinions of the 261 reporting zamindars, checked to some extent by observations and the results of experiments at Cawnpore. The results of the Cawnpore experiments agree very fairly with the estimates given by the reporters. The estimates are as follows:—A full average yield on the present area would have been 60,000 tons of cotton and 92 000 tons of til. Yield of present according to the estimates of reporters and Cawnpore experiment 40,000 tons of cotton and 50,000 tons of til. This is the first estimate of the sort that has been attempted with regard to til at least; and it is given with some diffidence. Quantities of cotton and til available for export.—The annual consumpion of clean cotton by the people of the United Provinces may be put at rather under than over 200,000 tons. The annual consumption of til (including seed) may be put at about 41,000 tons. The cotton and til crops of last year were poor and probably little or no surplus was left. If therefore the estimates of the yields of the present harvest are near the mark, there should be in the country, available for export, 20,000 tons of clean cotton and 9,000 tons of til seed.

The report for November 1885 on the prospects of the Wheat Crop in the Central Provinces is as follows:—This year again the area under wheat has been contracted by the early cessation of the monsoon and drying of the ground before sowing time. At the commencement of October prospects were not good and cultivators had commenced sowing earlier than usual in order to give the seed the benefit of what moisture remained; fortunately the greater part of the

Provinces received a good fall of rain towards the end of the month which, while it injured past sowings, allowed the making of fresh ones under greatly improved conditions. The rain was heaviest in Chhattisgarh and lightest in the north-west of the Provinces, where some tracts escaped it, altogether in these tracts, principally comprised in the Narsingpur and Seoni districts, the crop may be below average, but over the remaining area of the Provinces prospects were reported fairly good before the occurrence of the present rain, and now they may be regarded as very hopeful, the condition of the crop is particularly good in Chhattisgarh.

The second report on the prospects of the Wheat Crop in the Bombay Presidency :—*Sind.*—Returns incomplete, but area apparently well up to average. *Gujrat.*—Latest reports show Ahmedabad and Panch Mahals only below average, but the decrease in former, amounting to 100,000 acres, reduces gross area to 250,000 acres as compared with 350,000 acres average. *Baroda.*—Returns not submitted. *Kathiawar.*—Area 200,000 acres as against 133,000 acres last year, in other States area 75,000 acres; dry crop wheat in Ahmedabad and Panch Mahals suffering, elsewhere crop healthy; in Broach crop forward and excellent, but rust from cloudy weather feared. *Deccan.*—Revised area 1,025,000 acres, being no less than 200,000 acres above average; the hoped for rain (see last forecast) came and has greatly improved prospects; as yet no signs of rust which resulted from December rain last year; in Nasik slight injury from frost, more than average quantity and quality of crop anticipated. *Karnatic.*—Smut has shown itself, but the people hope that it is a sign that there will not be rust; prospects of large and good crop entertained which, owing to railway, will be available for export. Taking 100 as average, the area for British Districts, excluding Sind, is 100 compared with 117 last year; in Native States, excluding Baroda, the area does not differ for the two years.

The report for December on the prospects of the Cotton Crop in the Bombay Presidency:—*Sindh.*—Information as to condition meagre, blight reported in places. *Gujrat*—In Broach light soil cotton suffering from want of moisture, but generally crop exceptionally forward and excellent, cloudy weather causes apprehension of blight in other districts except in the Panch Mahals where the crop is thriving; in Ahmedabad the September rain was insufficient. *Deccan*—Khandesh, as before reported, has a plenteous and good crop in parts, but as a rule the crop is again short; here, as in other districts, the December rain was injurious to the crop. *Karnatic*—In Dharwar crops healthy and promising though sown late, exotic cotton especially promising; in Bijapur and Belgaum crop fair, the east winds have been moderate. On the whole, cotton promises a much finer crop than last year; the figures returned do not yet justify any estimate of outturn.

The report on the prospects of the Wheat Crop in the Berars for the month of December :—The area under wheat is 814,692 acres against 807,305 acres, the average for the last four years. The crop is nearly a foot high, and so far there is every promise of a good harvest.

The report on the prospects of Wheat Crops in the Berars for the month of January 1886 :—Estimated acreage under wheat 804,682 acres, slightly below the average, which is 807,305 acres. The crops are generally in excellent condition; a humbler crop is expected in four districts, and a crop quite up to, if not over, the average in the remaining two districts.

The report on the prospects of the rice crop in Burma for December 1885 :—The total area under cultivation in the ten surplus districts is now reported as 3,234,091 acres, or 142,046 acres more than last year. The estimate of the outturn made last month by the District Officers is maintained, and in the Tharrawaddy district the estimate has been slightly raised. Fears have been expressed lest the want of Upper Burma labour in consequence of the war operations, should delay the reaping of the crop and reduce the outturn: it appears, however, that although the wages of labour are considerably more than usual in some districts, the cultivators are reaping their crops by working themselves with their families more than usual, or by employing Madras labourers. In parts of the Pegu district, where dacoities by large bands have occurred, there has been delay in reaping the crop, and some damage has been done, as the over-ripe grain has fallen to the ground and been lost; the damage due to this cause is estimated at 16,000 acres. In Shwegyin and Amherst, similar disturbances have occurred, but the reaping operations have only been interrupted to a small extent, as the dacoit bands have chiefly attacked towns and large villages; the principal dacoit gangs have now been broken up, the damage hitherto done is slight, and there is no reason to reduce the estimate given last month. The exportable surplus remains at 1,000,000 tons.

Some 43,000 acres were set aside in Ceylon in 1883-84 for the cultivation of tea. To bring next season's (1885-86) shipments up to $6\frac{1}{2}$ million pounds, 150 lbs. from each acre will be required. But it is by no means unusual to get 500 to 800, and even in favourable circumstances 1,000 lbs, of tea per acre, so Messrs. Rucker and Bencroft, the London brokers, calculate that, without further adding to the area of cultivation, the above acreage is capable of sending forward, at 590 lbs. per acre, at least 21,500,000 lbs of tea. But planting has been rapidly pushed forward, and private advices are to the effect that something like 700,000 acres are under cultivation. This would point to an ultimate export of from 50 to 60 million pounds.

Respecting the Adelaide market and Australian crop prospects generally, we quote the following from the Adelaide Milling and Mercantile Company's

circular : — "There has been no demand for shipment, the only buyers being millers, who operate only for immediate requirements. We note the sale of two fairly large lots of 10,000 bushels and 20,000 bushels respectively at 4s. deliverd at Port Adelaide. New wheat is not as yet coming to market in quantity; the sample is somewhat shrivelled, and note equ l to last year's. The yield proves most unsatisfactory and an average of over 4 bushels a acre cannot be hoped for. In many of the Northern areas the farmers will hardly reap seed and feed, and this is scarcely to be wondered at when the rainfall in some place only registered about 7 inches for the year. The Victorian harvest is also below an average, and from New South Wals and Queensland the reports are anything but satisfactory. Our own export of breadstuffs will be quite 200,000 tons less than last year, whilst that of Victoria will be about the same. Our total export for the year to date is close on 820,000 tons, of which only 68,000 tons have gone away as flour."

The Salt Revenue, omitting miscellaneous salt receipts for the first eight months of the current financial year, has amounted to Rs 3,89,61,000 or 2,000,000 maunds as compared with Rs 3,38,22,000 or 17,381,000 maunds during the corresponding period of last year.

Irrigation works in the Madras Presidency are generally remunerative, some of them paying as much as 10 and 11 per cent. interest on capital. At present all those that are in working order are paying upwards of 3½ per cent.

From a Tabular Statement Published in Bombay it appears that the quantity of plain cottons imported to Calcutta during the year 1885 was 247,550 bales, 60,382 cases, containing 773,316,619 yards. Of coloured cottons 88,577,107 yards were imported, of printed cottons 51,613,439 yards, and of twist 13,750,980 lbs.

In order to encourage the growth of the date palm, which might afford a considerable supply of food for the people in time of famine, and which is but little affected by drought, the Government of India has ordered fifty lbs. of the best variety of seeds from Bussorah for an experiment. The seed will be planted out by the Forest Department.

EXTRACT.

Continental Seed Control Stations.

No one who knows anything of the progress of agriculture will deny that that progress is due in no small measure to the investigations of of scientific men.

The application of science to agriculture has done much to improve our practice as well as to explain it.

Closely connected with this advance are the various agricultural societies and associations of our country and of the continent, as well as special stations established for scientific research in connection with agriculture.

These stations have various functions to perform. In their purely scientific aspects they have to deal with the examination of soils, the effects of various manures on our cultivated plants, plant physiology, the diseases of plants, forestry, the cultivation of moors, the cultivation of fruit, the feeding of stock, and so on. The researches carried on and the results obtained at the various stations are published specially by the stations themselves, or given to the world in the agricultural journals.

In addition, those connected with the stations frequently deliver lectures to agricultural societies, or students on their own special department.

This educational function is a very important one, and should be carefully fostered rather than neglected, as is too often the case. In our own country, for example, it is not at all difficult for a student to obtain instruction in general agriculture, but suppose he wishes to make a study of some special department, then it becomes exceedingly difficult, if not impossible, to obtain the instruction desired. As Liebig long ago remarked, none of the students of the agricultural schools who had come before him were able to distinguish the grasses or their seeds. Either the student must resort to one of our foreign schools, or provide himself with, and master, a very extensive and scattered literature written in many tongues. In the one case he obtains from the specialist in a few months as much knowledge as he could obtain by reading for as many years.

This educational value of the stations is largely taken advantage of by our continental neighbours, and why should we not develop the educational resources of those stations already established in our country? The Highland and Agricultural Society of Scotland has already organized special courses of instruction in agricultural chemistry, and it might be advisable to extend further in the same direction.

Take the case of a seedsman who wishes to be able to examine the seed which he purchases. To do this efficiently he must have a certain acquaintance with the microscope, and a certain amount of botanical knowledge. If he does not possess these qualifications he is liable to be imposed

upon, and in turn to impose upon his customers. Such cases are very common, and not only become a source of loss to the former but to the community at large. The remedy for such a state of matters is not far to seek. Let our seedsmen have an opportunity for learning the special science connected with seeds, and how to detect impurity and adulteration, and they will surely take advantage of it, and thus be in a position to supply their customers with genuine seeds. It might in fact be worthy of consideration by our agricultural societies whether it would be advisable in the interest of the farmers and the community that our seedsmen should undergo an examination and receive a diploma of proficiency, just as the druggist or the professional man. Grant that the seedsman has a proper knowledge, then the great seed sellers will have no scope for the practice of "doctoring"; and "doctored" and adulterated seeds will require to find a market somewhere else than in Britain.

In addition to the scientific and educational aspect of the stations, they have also a commercial function, inasmuch as they control by analysis or otherwise various substances of importance to the agriculturist, and determine their market value. These are the control stations. The control stations of most importance are those connected with seeds, manures, and food-stuffs.

Foundation of Seed Control Stations.

In April 1866, a Saxon farmer sent to Professor Nobbe of Tharand four or five samples of grass seeds for botanical recognition The examination of the sample labelled *Festuca Pratensis* showed only 30 per cent. of genuine seed. Professor Nobbe at once directed his attention to the costly agricultural seeds, and bought small quantities from the larger seed houses of Germany. He published the results of analyses of these in the agricultural journals, and at the same time invited the Saxon farmers to send in small quantities of their seeds for examination. Such was the origin of the first seed control station in Tharand, May 1869. His notice to the farmer ran as follows :—" Considering that the quality of the seed is an object of well-known importance in determining the amount of produce, it appears to us a pressing necessity that the use of adulterated or impure seeds should be as far as possible stopped. If the control of the manure market is considered as one of the main objects of the chemical station, so in our opinion the physiological station is called upon to control the seed market. We have resolved to carry out such seed control, and accordingly invite the members of the Dresden Agricultural Society, to whose liberal support we owe the very origin of our station, to send us samples of seeds with the name of the firm from whom they have been purchased. The examination will be confined to the determination of the purity and germination, and our report will be published in the local agricultural press."

In August of the same year the following notice appeared :—

"The purpose of the seed control station at Tharand is to protect farmers as far as possible from any injury which might arise from the use of impure, adulterated, or non-germinating seeds. Farmers in the Dresden district are invited to send samples of seed for analysis through the Dresden Agricultural Society, giving the name of the firm from which they were purchased, and the price at which they were bought. The purity and germinating power will be determined free of charge at the Tharand Seed Control Station."

Soon a number of scientific men followed Nobbe's example, and seed control stations sprang up all over Germany to meet the necessities of the various districts. There are altogether 16 such stations in Germany with a total revenue of £7,870.

After a number of seed control stations had been formed on the lines laid down by Nobbe, it became apparent to those who had the matter most deeply at heart that a unity of action and unformity of method were necessary to secure the success of, and inspire confidence in, the stations.

United Action of the Seed Control Stations.

This was secured by calling together the directors of the seed control stations and others interested in the matter to form an association. The first meeting of this association was held at Graz in 1875. The object of this meeting was to discuss and consider the methods of procedure best adapted for controlling the seed market. Such a meeting was very necessary in order to get rid of any danger which might arise to the stations from dissimilar methods of procedure. The conductors of the stations saw quite well that great discredit might be cast upon their work if, on account of different methods of procedure, the results issued by the different stations did not agree with one another. It also seemed of importance that seedsmen should be aware of the methods by which their seeds would be judged at the seed stations.

The arrangements come to at this meeting are of great importance, and deserve very careful attention. With regard to the impurities present in seeds, it is important to observe that any ingredient, whether hurtful or not, and whether of higher or lower value, is regarded as an impurity.

The germination again is to be conducted in a certain way, at a certain temperature, and for a definite period of time. The "hard seeds" are to be specially mentioned in the report, and one-third of them are to be regarded as possibly capable of germination. These very matters will require consideration by ourselves; and whether we will agree with the continental stations or make our own arrangements remains to be settled. It is also worth while pointing out that the seed control stations do not undertake to decide in certain cases.

Relation of Seed Control to Seedsmen.

Before the establishment of seed control, the seed trade was a "trade of confidence" between the buyer and seller. These palmy days of "grass mixtures" and so on are now beginning to pass away.

Nobbe saw, when he founded seed control in 1869, that in the interests of their business some of the seedsmen would wish their seeds examined. He announced accordingly that seedsmen could have their seeds tested by the station at the rate of 3*s.* per sample of large seeds, and 6*s.* per sample of small seeds. He was willing to enter into contract with the seedsmen on the following stations :—

1. The contracting firm guarantees to its customers pure seeds of certain percentage of germinating power, and further that any deficiency from such percentage is to be made good to the buyer, or at the buyer's option the seeds may be returned. The responsibility of the firm terminates when the seeds are sown, any control being now impossible.

2. The purity and germination of the sample must be determined by the said station. The buyer has no counter clain on the seedsman from the result of growth in the field.

3. When a contract is made with a firm, the names of such firms shall be published, as well as the purity and germination of the seeds sold by that firm.

4. The contracting firm must pay a certain sum to the station, and has the privilege of sending to the station a certain number of samples for analysis.

Internal Arrangements of the Seed Stations.

In their internal arrangements the seed stations of the continent agree very closely with one another. I take as an example Professor Nobbe's station at Tharand. The laboratory there is a part of the Forest Academy. The great feature in the laboratory is the large collection of genuine seeds which are kept for reference, contained in clear glass bottles. Such collections of genuine seeds can be obtained at any time from Herr Paul Heming's assistant an dem Konigl. botanischen Museum der Universitat Berlin. Another portion of the laboratory displays for the benefit of the Professor's students the different impurities met with in agricultural seeds. The impurities in clover seeds are put together, and so on—thus the student can see at a glance the impurities found in any agricultural seed. Another portion is shelved, and partially curtained off for germinating purposes, no special heating apparatus being used. A consulting library, containing all the important literature connected with the work, occupies a prominent place. On the work table at the window are placed the microscopes and lenses necessary for determining the genuineness of the seeds. The lens in common use is provided with a three-legged stand, and into it is screwed the lens, which is thus capable of adjustment. Such lenses can be obtained at any of our opticians for 2s 6d. Near at hand is a delicate chemical balance on which all the weighings are made. The laboratory is also provided with a variety of apparatus for taking average samples of seed. The germinating apparatus used consists of a pair of ordinary plates, the upper one provided with a whole into which a small thermometer made for the purpose is inserted. Two samples of the same seed are placed in each pair of plates, and each sample of 100 seeds is folded up in blotting paper. The samples are examined daily, and watered by means of a wash bottle, and the results are entered in the books. If at the end of germination the pair of samples agree within 5 per cent, the the result is taken as correct. For large seeds the blotting paper is not well adapted, and these are accordingly germinated in Nobbe's germinating apparatus or in sand. The professor keeps two assistants, one for botanical, the other for experimental work. In addition several school girls are employed at stated hours for counting the seeds. Their work is so arranged as to be readily checked by the professor or his assistant.

Connected with the laboratory is a large glass house for experimental research in connection with plant nutrition. When I visited the laboratory in September, the professor was carrying on experiments with oat plants grown by water culture with and without solica. In addition I was shown a number of large trees—*Alnus glutinosa* in full fruit, which had been grown from the seed by water culture.—*Transactions of The Highland and Agricultural Society of Scotland, Vol. XVII.*

COTTON MILL MACHINERY.

For the benifit of those of our readers who are interested in the establishment in Mysore and Bangalore of the great cotton-spinning industry, we have obtained a list of the prices charged in England for engines, boilers, machines, stores etc., to complete a Mill of 10,000 spindles—of the size and requirements of the Mill that has been established here.

COST OF MACHINARY IN ENGLAND.

	£
Engine—Compound horizontal, to turn 200 indicated horse power, etc., etc. with firm foundations	1,600
2 Boilers—steel, to work daily 80 lbs to square inch,—complete	860
Economizer	384
Donkey Pumps	60
Mill Gearing	1,050
Card Room and Spining Machinery, and Stores and Sundries	9,208
Total	£13,162

£13,162 at Rs. 13 per £1 = Rs. 1,71,106.

The cost of the Maharajah Mill Machinery, according to specification, is as follows:—

	Rs.
Engine	40,000
2 Boilers	32,000
Economizer	6,000
Donkey Pumps	1,000
Mill Gearing	26,000
Card Room and Spining Machinery, and Stores and Sundries	2,05,340
Total	Rs 3,10,340

In our case—that is, the case of our local Mills—the Building has cost the Company Rs 1,13,610, and the Machinery and Store Rs 3,10 340,—a total of Rs. 4,23,950, or say Rs 40 10-0 the spindle. These figures are well worth studying.—*Bangalore Spectator.*

CALCUTTA MARKET REPORT

FOR THE

MONTH OF JANUARY, 1886.

Indigo.—During the first week 2,084 chests were offered at two public sales and 3,018 sold. Good and fine indigo sold at the previous rates, while middling and defective sorts ruled rather high. Oudes and Benares continued to command higher prices. The total quantity out of the market at the end of the week was about 78,600 maunds. During the second week four public sales were held at which 4,086 chest were offered and 4,036 sold. The market was rather easy on Thursday, but on the following day it was firmer again. The quantity out of the market amounted to about 94,500 maunds. During the third week four public sales were held at which 3,482 chests were offered and 3,264 found buyers. There was a decline of Rs 5 in the price of fine indigo. The total quantity out of the market amounted to about 1,07,000 maunds. During the fourth week there was only one auction at which 400 chests were sold at the prices previously current. One more public sale will be held after which the season will close.

Tea.—At the sales held on the 7th Instant, 22,181 packages were offered of which 21,953 were disposed of. Prices were irregular and had a downward tendency. Pekoes and Broken Pekoes over 10 annas per lb, were about half an anna lower, while the higher grade declined still more. At the auctions in London 27,000 packages of Indian tea were offered of which 23,500 were disposed of. Prices were generally easier, there being a decline of 1*d.* to 2*d.* for the finer qualities. On the 14th Instant 12,200 packages were offered at the public sales of which 12,000 found buyers. The demand was quiet, and prices ruled even. At the London auctions 24 600 package out of 28,000 offered were sold. Common qualities were firm, other descriptions being easier. On the 21st Instant public sales were held at which 9,570 packages were offered and 9,470 disposed of. At the London auctions 24 000 packages were offered and 18,800 sold. The prices were rather low.

Wheat.—No transactions were reported during the first week either in old or in new crop. Quotations were Rs 2-9 for No. 1; and Rs 2-7-6 for No. 2 Club. During the second week about 2,000 tons of the Cawnpore quality were reported to have been desposed of at Rs 2-7-6, April-May delivery. During the third week, the sales consisted of 1,600 tons of old Fyzabad at Rs 2-5-6 to Rs 2-6; and about 1,000 tons, new Club No. 2 at Rs 2-7-6 for April-May delivery. During the fourth week sale was reported of about 3,000 tons of Club No. 2 for April-May delivery at Rs 2-7 6.

Oil-Seeds.—During the first week transactions were restricted to a few hundred tons of the new crop Linseed, April-May delivery, at Rs 3-15-6 for

small grain, 5 per cent refraction. During the second week about 500 tons of old linseed crop were sold on the spot at Rs 4-7 to Rs 4-7-6 and about 4,000 tons of new crop mostly small grain, 5 per cent refraction, at Rs 3-15-3 and 3-13-6, April-May delivery. During the third week about 2,500 tons of new linseed found buyers at Rs 3-15-9 for April-May delivery. The old crop seemed to have exhausted. During the fourth week, linseed was in great demand for forward delivery. The transaction comprised about 6,000 tons at Rs 3-15-9 to Rs 4 for April-May delivery and a few sale for February at Rs 4-4, and for March at Rs 4-2.

Jute.—During the first and the second week, the market was quiet at unchanged prices. During the third week the demand was rather better. First native marks were quoted at Rs 20 to Rs 21. During the fourth week there was as a better enquiry for this article, and a fine business was put through at previous prices which were well maintained.

CROP AND WEATHER REPORT.

6TH JANUARY 1886.

General Remarks.—Rain has fallen during the week under review in a few districts in Madras and the North-Western Provinces and Oudh and Punjab. Elsewhere the week has been rainless.

In Madras the standing crops are generally in good condition. The harvest is yielding generally average or below the average. In Mysore and Coorg agricultural prospects continue favourable; in the former the sowing of paddy and Bengal gram is in progress. The harvesting of dry crops has been completed in parts of Bangalore.

In Bombay the kharif harvest and rabi sowings have been completed except in parts of three districts. In parts of Khandesh the rabi is urgently in want of rain, elsewhere the prospects of the crop are generally good. In the Berars, Hyderabad, Central India and Rajputana the rabi generally promises very well.

Rabi prospects are also very favourable in the North-Western Provinces and Oudh, Punjab and the Central Provinces, where a good harvest may be expected.

In Bengal the aman harvest which is approaching completion is yielding a satisfactory outturn, and the rabi is everywhere in excellent condition. The poppy crop in Behar and Hazareebagh is also very promising. Agricultural prospects continue good in Assam.

In British Burma the rice harvest continues in progress.

The public health remains good in most Provinces.

Prices are fluctuating in the Punjab and are slightly rising in Coorg. In some districts of Bengal the price of rice is higher than last week. Elsewhere prices continue generally steady.

13TH JANUARY 1886.

General Remarks.—Except in the Tanjore and Madura districts of the Madras Presidency and the Sialkot district of the Punjab, the week has been almost rainless.

Agricultural prospects are generally fair in the Madras Presidency, but in some districts the outturn of the paddy harvest is below the avarage. In Mysore, with the exception of parts of the Tumkur district, and in Coorg, prospects are favourable.

In Bombay the rabi crops are generally promising, though in some places injury has been caused by drought, cloud weather, and insects The kharif harvest has been completed except in parts of Surat and Dharwar. In the Berars, Central India, and Rajputana the prospects of the rabi continue favourable.

Rabi crops are thriving and prospects are good throughout the North-Western Provinces and Oudh, the Punjab, and the Central Provinces.

The rice harvest has been almost completed in Bengal, with, except on the deeply flooded tracts, a generally good outturn. The prospects of all cold-weather crops including pppoy are good. In Assam the reaping of the sali crop still continues, and prospects are good.

In British Burma the rice crop has been nearly reaped.

The public health continues generally good in all Provinces.

Prices are fluctuating in the North-Western Provinces and and Oudh and Punjab, and are falling in parts of Bengal and in Coorg. Elsewhere they are fairly steady.

20TH JANUARY 1886.

General Remarks.—Rain has fallen in nearly all districts of the Punjab, and in parts of Rajputana, and there have been slight shower in parts of the North-Western Provinces and Oudh, Sind, and the Southern Districts of the Madras Presidency.

Agricultural prospects continue fair in the Madras Presidency, but pressure from loss of the paddy crop is reported from part of the Ganjam district. In Mysore and Coorg the season promises well. The harvest has been completed in some parts and is in progress elsewhere.

Except in some places where injury has been caused by blight, drought, and cloudy weather, the rabi crops in the Bombay Presidency promise well. Prospects are also good in the Berars, Hyderabad, Central India, and Rajputana. Throughout the Punjab and the North-Western Provinces and Oudh the rabi is flourishing, and harvest prospects are good. In the Shahpur district of the Punjab fodder is very scarce. In the Central Provinces the corps promise well unless injured by cloudly weather.

The aman harvest is nearly complete in Bengal, where the rabi and, except in Shahabad, the poppy crops are in excellent condition. In Assam prospects continue favourable.

In British Burma the reaping of the rice crop has been finished in some districts and is well advanced elsewhere.

The public health is generally good in all provinces.

Prices are fluctuating in the North-Western Provinces and Oudh, the Punjab, and Mysore, and are falling in Croog; elsewhere they are generally steady.

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The resolution of the Government of Bombay which we reproduce in another column on the annual Report of the Director of Agriculture in the Bombay Presidency for 1885 has just been published. It bears ample testimony to the useful work that is being done by Mr. Ozanne in Bombay and serves as a complete answer to what fell from Hon'ble Mr. Mandlik during the debate on Income Tax Bill. The Hon'ble member observed:—"I must confess that I look upon the outlay on this Department (Agricultural Department) as utterly disproportionate to the results expected to be achieved. For better or worse, India is not a country of large farms and the employment of expensive machinery." We are really glad to see that Mr. Mandlik raised his voice against the introduction of large farms or of expensive machinery as quite unsuited to the means and position of the Indian Ryot and, if these were the only or primary objects of the Agricultural Department of the Bombay Presidency, we should have joined with him in condemning it. But evidently he appears to misconceive the real aim of the department and the goal to which it is driving. He appears to think that the department has to do little more than promote large farms and introduce expensive agricultural machinery and implements beyond the means or unsuited to the working capacity of the ordinary Indian ryot. He is evidently ill-formed on the subject.

* *

A glance at the recommendations of the Famine Commissioners to which the Agricultural Department owes its existence, will show that with a view to administer effective famine relief and eventually to introduce improvements in Indian agriculture—for it is the height of absurdity to suppose than Indian agriculture is incapable of improvement—*agricultural enquiry*, that is, the collection of all available agricultural and other economic information should be the first and foremost duty of the department. The resolution on Mr. Ozanne's report shows that the energies of the Director of Agriculture in the Bombay Presidency have been applied during the year "not towards the extension of Agricultural farms, nor the use of costly machinery but towards fulfilling those objects, special and general, for which the Famine Commission recommended the creation of the Agricultural Department." As an instance of the spirit of enquiry which pervades the actions of Mr. Ozanne, we may cite his researches designed for the purpose of ascertaining the precise value of *rab* in the cultivation of rice crops, in the results of which the Agricultural community in Thana and other districts of the Bombay Presidency are deeply interested. The experiments conducted, detailed reports of which have from time to time been published in the pages of this journal, so far tend to show that the use of rab promotes a larger yield of rice. Besides it must be remembered that the department is only being organised now and to ask it to show grand results in its formative stage, is to ask it to work miracles. The unqualified testimony of the Government of Bombay on the aptitude and tact shown by Mr. Ozanne in organizing the new department in the head of which he has been placed has our entire accord.

We have received a copy of the resolution of the Government of Bombay on the report of the Director of Agriculture on the Government Farms at Bhadgaon and Hyderabad. There is nothing in it which calls for any special remark excepting what is said about the value of ashes of cow-dung. While reviewing the report of Mr Stormont, the Superintendent of the Bhadgaon Experimental Farm, we had occasion to remark as Mr. Ozanne has now done that his deductions were not likely to be correct. For apprising our readers of the grounds of our assertion we reproduce here the remarks we then made. "In one part the report goes on to say: 'In the burning of cow-dung, the cultivator no doubt loses something in the shape of manure; the ashes however which are carefully restored to the soil are capable of giving results not very much inferior to the fresh article.' The cultivator does not however in the process of burning, lose only something but the most important and valuable thing in the manure. One ton of an average sample of farm-yard-manure usually contains 9-15 lbs. of nitrogen, a similar amount of potash, and 4-5 lbs. of phosphoric acid. Of these three manurial constituents, nitrogen is about 12 times more valuable than the others and, in the process of burning, this valuable part is entirely lost. So much of what is written about the wicked use of cow-dung fuel, is not far short of truth."

*

Of the communications read at the December meeting of the Agricultural and Horticultural Society of India, the following may interest our readers. A note has been received on the result of the cultivation of *Reana Luxurians*, a fodder grass, by Kumar Jai Narain Singh at Didwarry, Meerut district. The grass is said to have withstood the frost during the cold weather and a severe drought and floods. Other Kharif crops, including the Early Amber Sorghum, succumbed to the innundations, but the Reana continued green, rising to about ten feet from the ground. In this instance the seed was sown in seed-beds and transplanted to the field. In a separate communication on Rhea, Mr. Jennings mentions that his paper embodies the conclusion he has arrived at after much careful personal study, and though he is in favour of the process of which he gives an account, he does not wish it to be taken as his opinion that perfection has been attained. What he wishes to show is, that whatever improvements may hereafter be introduced, there is *already* a system under which Rhea can be prepared for market at a comparatively small cost. Mr. Jennings alludes to the opinion respecting fibre prepared by violent beating by machinery, being deprived of much of its elasticity, a conclusion which an independent observer experimenting in India has also formed. M. Favier of France has discovered a method by which he extracts and cleans annually the fibres of thousands of tons of rhea but the method is so very simple that "it does not admit" he says "of being patented." He carefully excludes all outsiders and foreigners from the premises where the machinery works. We are led to think that over and above mechanical appliances he used chemical reagents. He pays so much per ton of rhea stalks supplied to him by any growers, provided they do not fall below a certain standard. He derives a large stock of rhea from Algeria and other foreign countries. Along with the extraction of fibres he has workshops where carpets are manufactured out of the cleaned fibres, a few of specimens of which he has kindly placed at our disposal.

From the returns of the Railway-borne traffic of the United Provinces for the quarter ending 30th September, 1885, we learn that agricultural products formed nearly 50 per cent. of the entire traffic during this quarter. The most important features of the quarter were :—Low prices of all the agricultural produce in every division of the united provinces with only a few exceptions due to local causes. A large increase in the exports of wheat took place in the quarter under review. The hopes expressed in the report for the quarter ending 31st March, 1885, and the prediction hazarded in the final wheat forecast of May, 1885, have been fully realized. The large wheat harvest, low prices, abundance of other food-grains, the low rates of exchange and of sea freight, were all favourable to the expansion of the wheat trade with England. The exports during the quarter were more than 130 per cent. larger than those of the corresponding quarter of 1884 and over 57 per cent. more than the average exports during the same period in the previous five years.

	Mds.
Total exports of wheat during July, August, and September, 1885	24,25,320
Total exports of wheat during July, August, and September, 1884	10,53,224
Average exports of wheat during the three months July, August and September from 1880 to 1884	15,43,610

Adding the exports during the preceding three months (April to June), the total exports out of the wheat crop of 1885 exceed 49½ lakhs maunds. This is considerably in excess of the wheat exports in the same period of any previous year, with the exception of 1883. Large stocks were believed to be still in hand, and it was the general opinion of merchants in the Meerut Division that, if the prices at home had been only a little higher, the exports would have exceeded the scale which they attained in 1883. Of the entire exports, Calcutta took nearly 80 per cent., while Bombay took little over 16 per cent. All over the North-Western Provinces and Oudh, railway freight rates on wheat consigned to Calcutta were lower than on consignments to Bombay. It is only for a few places in the Agra and Meerut Divisions that the sea-freight turns the scale in favor of Bombay. As a consequence, we find that exports of wheat from the Meerut Division were divided between Calcutta and Bombay in the proportion of 5 to 4, while the produce from Allahabad, Benares, Rohilkhand, and Oudh generally found its way to Calcutta. Of grains other than wheat there was an increased export all round, gram to Bengal coming foremost. Total exports of grains besides wheat were 2,49,097 maunds during 1884 and 10,52,466 maunds, during 1885.

The linseed crop of 1885 was the best that we have had for several years and compensated fully for the loss sustained in rape seed from the ravages of fungoid disease in February, 1885. The total exports of linseed amounted to 5,27,745 maunds, or nearly 200 per cent, larger than the exports during the corresponding period of the preceding year. Calcutta took thrice as much as Bombay. Total exports of linseed during 1884 were 1,85,727 maunds and during 1885, 5,27,745, maunds.

There was an increase of nearly 24 lakhs of maunds in the export traffic and 13¼ lakhs of maunds in the import traffic. The increase of exports was in wheat, other grains, and linseed; the increase of imports was chiefly in salt, coal, and railway materials. The Ganges Canal closed in August, and the Agra Canal in September, for the annual repairs. The total traffic amounted to 76,929 maunds on the Ganges and 48,659 maunds on the Agra Canal. Of the former amount, the share of Cawnpore was 38,658 maunds, or more than half of the total traffic. The traffic of the Ganges Canal, as in the previous quarter, consisted chiefly of grains, seeds, and sugar imported into Cawnpore, and of timber and other building materials exported from Saharanpur to other districts of the Meerut Division. The traffic of the Agra Canal consisted for the most part of grains imported into Agra from the Gurgaon and Delhi districts and of salt exported from Agra.

Mr. Bookwalter, a high commercial authority in New York, has contributed an important article to *Bradstreet's* on the direction of international trade, in the course of which he declares that the American farmer no longer holds, as he once held, the position of dictator in European grain markets. It is rather the "six cent ryot of India," he says, who now takes precedence, and who is able, if not to supply all the wheat which Europe requires, at least so to load the market with his cheap produce as to depress prices below a level remunerative to the American grower. The reason Mr. Bookwalter believes to be the exclusive tendency of the American tariff, which greatly restricts trade with England, American's best customer. For the cotton industry he thinks there is still hope, if wise counsels prevail soon enough, but a persistent denial of equitable trade relations will have the same effect upon the export trade in cotton as on that in grain, and the time is not far distant when the cotton planter of the Southern States " will be thrust from his high place, and the despised Egyptian fellah will reign in his stead." In the case of the grain supply, however, it is certain that America is her own chief enemy. Evidence from the best authorities appears to show that American wheat, under ordinary circumstances, can be laid down in England at lower price than Indian wheat; but the English buy where they sell, and their increasing trade with India, with an improvement in the railway system of the country and cheap freights, will certainly turn the balance in favour of India.

In 1884 Chili sent to England 378,750 qrs. of wheat and in 1885 the quantity was 246,392 qrs. Very little advance, however, appears to have been made lately in Chilian agriculture. There are a few model farms in Chili belonging to wealthy proprietors, but, as a rule, everything connected with farming is very backward. The Chilian farmer still ploughs with a pointed piece of wood, sometimes shod with iron, and his harrow is a bundle of bushes. Reaping is done by hand, and thrashing by driving horses over the corn. The yield of wheat averages only four bushels to the acre, and there is four per cent of dirt in the grain. The total annual produce of wheat is about 2,250,000

qrs. The area of land under tillage was about 6,000,000 acres in 1880, and it appears to be about the same now. The average value of all crops is set at only five dollars per acre, a very poor result. Vine growing is probably the most successful branch of Chilian agriculture. Vineyards occupy about 100,000 acres, and the average production of wine is some 14,000,000 gallons, of superior quality to that produced on the other side of the Andes, in the Argentine Republic. Tobacco is also extensively cultivated for home consumption. The number of live stock, comprising cattle, sheep, and horses, is believed to be under 4,000,000 altogether. Chilian agriculture is much older than that of California, as the gold miners were fed on Chilian flour; yet a comparison of the existing agricultural resources of the two countries would be absurd.

The following table gives the total values of the commerce of France in 1885 as taken from the Custom returns :-

	Imports	Exports
	£	£
Articles of Food	55,218,720	28,537,680
Raw Materials	82,216,800	26,500,963
Manufactured Goods ...	23,546,600	65,189,720
Miscellaneous	7,652,960	7,172,880
Totals 1885... ...	168,635,080	127,401,249
Totals 1884... ...	173,739,160	129,300,000

The co-operative principle is still making rapid strides amongst farmers. The syndicate formed less than a year age in the Loire-Inferieure counts already 600 members, and disposes of 12,000 kilos of seed, and 818,000 kilos of manures of all descriptions. The manufactures of wine from dried imported raisins seems likely to receive a check as far as Paris is concerned; for the municipal council has estimated at £ 80,000 the loss of its revenues from this clandestine industry. The Prefect of the Seine has engaged to present a Bill to the Chambers this season with the object of putting a stop to the abuse. M. Develle, the new Minister of Agriculture, has promised the Tariff Commission special aid and information, this last to be derived by sending commissioners to America and India.

* * *

There seems to be a complete block or stoppage in the ground-nut trade at the opening of the present season's straffic; it is agreed on all sides that the crop is enormous, but present Marseilles quotations for delivery are less than Pondicherry local rates. Of course, this state of things will not last long; just now the steam oil mills and the native crushing machines are consuming something like 200 candies of nut per day to meet the large and unexpected demand for ground-nut oil in Burmah, Calcutta, and the northern ports; and considerable quantities of nuts, in shell and kernel, have been shipped to Calcutta and the Straits: but the whole of these demands are purely insignificant when brought face to face with a crop of at least half-a-million of candies. As matters now stand, Marseilles manufacturers will not buy—they prefer to wait results, and producers will not sell, for the same reason—hence the block.

* * *

Bengal can boast of very few manufactures and works of art but of these few even, our knowledge is very scanty. The principal manufactures in the Presidency Division are indigo, silk and sugar. The first is manufactured in Nuddea, Jessore and Murshidabad districts. Silk is only produced in the Murshidabad district and the industry has been on the decline. Jessore and Khulna are the seats of extensive sugar manufacture, while in the Bashirhat subdivision of the 24-Pergunnahs there are also some minor sugar works.

* * *

In the Bhagulpore Divison, some fine specimens of copper ore—oxides, sulphides, and carbonates—have been extracted but it has not yet been ascertained whether these ores will be found remunerative to work. There are seven coal quarries at work or about to be worked on the Government Estate Damin-i-koh in the Sonthal Pergunnahs, while the copper mine at Tulsitar is still in the experimental stage. The manufacture of indigo is dying out in Purnea, Maldah and the Sonthal Pergunnahs but still holds its own in the Monghyr and Bhagulpore districts. The silk industry as in Murshidabad is declining. Imported iron has largely taken the place of iron smelted in the Sonthal Pergunnahs. The manufacture of guns at Monghyr and the lac industry at Jesidia continue to flourish.

In the Rajshahye Division indigo and silk industries are steadily declining. The manufacture of gunny bags, jute cloth and country cloths is said to be in a flourishing state. Molasses is largely exported from Dinajpore, Rajshahye and Rungpore. There is an important copper-mine in Sikkim which gives employment to 100 miners. In the Dacca Division the Naraingunj jute-mills are well-known. Cloth weaving, especially fine Dacca muslins, continues to decline. The important

trade of shell working is on the wane in Dacca while gold and silver ornaments are taking their place. Owing to an increasing competition of machine-made oil and of kerosine oil, the manufacture of cocoanut, mustard, and sesamum oil in wooden presses is declining in Backergunj. In the Patna Division, the chief manufactures are indigo, sugar, saltpetre, tobacco, paper and opium which last is a Government monopoly. The paper industry is not thriving. The tobacco factory of Messrs Begg Dunlop at Poosah is said to give promise of larger success. Manufacture of saltpetre is stationery or shrinking excepting in Chumparun. The area under sugar-cane and the outturn of sugar have increased in Shahabad. Indigo is the most important manufacturing industry in the Division.

In the Chota Nagpur Division, the lac industry is stationery, whereas the manufacture of *gur* in Manbhoom and of catechu in Hazaribagh is on the increase. The collieries in Hazaribagh and Manbhoom and the talc mines in north Hazaribagh are in good working order. A copper mine is being worked at Baraganda and is likely to prove remunerative. In the Burdwan Division, the manufacture of mulberry silk is declining year by year, while the Tusser silk has been more in demand and the outturn in Birbhoom was valued at Rs 96,030 in 1884-85 as against Rs 46,675 in 1883-84. The industry in the country-made cloth continues to decline. There are ten jute mills in the division of which one was closed in 1884-85. Brass and bell-metal utensils continue to be largoly manufactured in the Hughli and Burdwan districts. The sales of iron from Government iron works at Barakar are increasing.

Messrs Burn and Company's pottery works at Raniganj continue to prosper. They employ 700 men daily and the value of their outturn in 1884-85 was estimated at Rs. 2,15,000. The coal industry is suffering from the depression of trade. In the Chittagong and Orissa Division manufactures are few and unimportant except salt on the sea-front of the Orissa Division, the manufacture of which has considerably decreased in Pooree and Balasore.

The total outlay, direct and indirect, to the close of the year 1885-86 on canals in Bengal has been Rs. 6,77,31,843. Of this sum, Rs. 7,00,000, have been contributed by the Imperial Government from the Famine Protective grants, Rs. 82,61,636, have been provided from Provincial revenues, and Rs. 5,79,91,992 have been charged to Loan funds, interest on which is chargeable to the revenue of the province. In addition to the sums mentioned above Rs. 7,78,255 have been expended on surveys for irrigation works which have not been carried out. There are now in actual operation in Bengal 699¾ miles of canal, of which 489 miles are navigable. The total area commanded by these canals is 25,17,552 acres of which 483,243 acres, producing crops of the estimated value of Rs. 1,21,82,304 were irrigated during the current year. The number of boats plying in the canals during the year was 90,515, and 776,564 tons of goods of an approximate value of Rs. 2,73,50,552 were carried. The Sarun Canals, in which the area commanded can only be imperfectly irrigated, and the Calcutta and Eastern Canals, which are mostly composed of canalized rivers, have been excluded in making out the above figures. The net income for the year was therefore Rs. 3,34,722. Interest amounting to Rs. 22,12,626 was however payable to the Imperial Government, so that there was a deficit of Rs. 18,77,904 to be met from Provincial revenues. Compared with 1883-84, the recipts of the year show an improvement of Rs. 1,29,605, wholly due to the increased water rates received from the Sone Canals. There is a decrease of nearly one lakh of rupees in the revenue derived from the Orissa Canals, and a small falling off in the receipts from the Midnapur and Tidal Canals.

The total value of imports into British India including treasure during the nine months ending 31st December last was Rs. 52,14,85,711 as against Rs. 52,93,94,698 in the corresponding period of the previous year, while the total value of exports including treasure during the same period amounted to Rs. 59,23,69,433 as against Rs 60,37,14,315 in the corresponding nine months of the previous year. The universal depression from which trade suffers is not so much felt in India so far as the above figures go. For if we exclude treasure, there was a slight increase in the value of imports though there was visible a slight decrease in the value of exports. Amongst the articles of import, it will be interesting to notice that during the past nine months *ghee* was imported worth Rs 5,35,537 and *salted fish* worth Rs 8,95,774; and if we compare these figures with the corresponding ones of the previous two years, it is noticeable that under the former head there was an increase of nearly 4½ lakhs, and 1½ lakhs

respectively; and under the latter head an increase of about Rs $1\frac{1}{4}$ lakhs, and Rs 56 thousand respectively.

That the import trade in ghee and salted fish should gradually increase is a bad outlook for the industry and trade in indigenous products of India. In an article headed "Fish and their Culture" in the May number and another headed "Fish curing" in the December number of this gazette, we adverted to the question of neglect from which the industry in the cultivation and rearing of fish suffers universally in India. At the late fisheries exhibition held in London, India was not inadequately represented at a great cost to the State, but little practical good seems to be have resulted from this outlay. Sometime ago the Government of India with the laudable desire of collecting information on the subject, had engaged the services of a qualified specialist to visit the fisheries of the different provinces of India with a view to inform Government as to their condition and economic relation to food supply. Burma and Madras had engaged the greater part of his attention and the late development of the salted fish industry in the latter province is no doubt primarily owing to his researches. But the little good that has been done, at least by awakening an interest in the subject, has been almost lost to the public, without a permanent and organized agency to maintain up to date the researches once set on foot. Fish forms a more important factor in the dietary of the Indian population than that of any European country and requires greater attention and care than it has hitherto received from the Government.

Amongst other articles of import, it is curious to notice that an extensive tea-growing country like India should be indebted to foreign countries for Rs. 24,69,644 worth of *tea* during nine months ending 31st December 1885. Of this amount China supplied the greatest part, *viz.*, Rs 21,56,031 worth of tea. During the same period the value of silk imported was Rs 59,77,708, which show a diminution of about 3 lakhs 60 thousand and 21 lakhs rupees upon the total value of silk imports of the corresponding period of 1884 and 1883 respectively; and the value of silk exported was Rs 14,31,446 which shows a diminution of over 124 and 26 lakhs rupees upon the values of silk export of the corresponding period of 1884 and 1883 respectively. From the export figures it is plain that India is fast losing its former position as a silk exporting country. The diminution of imports which is comparatively small can however be explained by the depression from which trades are suffering universally. Moreover influx of cheap European piece-goods has no doubt had some share in diminishing the demand for silk and silk-manufactures amongst the Indians themselves. There was, slight diminution in the value of *aniline dyes*, *candles*, *watches*, *perfumery* and a considerable diminution in the value of *umbrella* imported, compared with the corresponding period of the previous year, while the value of *soaps* imported increased considerably. During these nine months the value of aniline dyes imported was Rs. 5,92,557; candles Rs. 6,62,370; matches Rs. 12,80,715; perfumery Rs. 4,00,971; soaps Rs. 6,23,024 and umbrellas Rs. 13,21,459. The import of these articles of luxury is gradually increasing, the slight diminution observed in the past nine months being no more than what can be accounted for by the recent general depression in trade.

1. Memoranda on the Prospects of the Wheat and Oilseed Crops of the United Provinces, of the Wheat Crop in the Central Provinces, of the Wheat Crop in the Punjab, of the Mustard Crop in Assam, of the Rice Crop in British Burma, of the Annual Forecast of the Linseed Crop in the Hyderabad assigned districts for the season 1885-86, of the Prospects of Wheat Crop in Berar, of the Indian Rice and Cotton Crop of the season 1885-86, and of the Indian Wheat Crop of the season 1885-86: From Government of India.
2. The Forecast of the Current year's Linseed-crop in the Central Provinces: From the Director of Agriculture, Central Provinces.
3. The Second or December Forecast of the Wheat and Oilseed crops of the United Provinces: From the Director of Agriculture, United Provinces.
4. The Proceedings of the December Meeting of the Agri-Horticultural Society of India: From the Deputy Secretary.
5. Resolution of the Government of Bombay on the Annual Reports of the Government Experimental Farms at Bhadgaon and Hyderabad, for the year ending 31st March 1885: From Government of India.
6. The Annual Report of the Government Botanical Gardens and Parks on the Nilgiris for 1884-85 with orders of the Madras Government on that: From Government of India.
7. The Mark Lane Express, Agricultural Journal published at Clement's Inn Passage, London, W. C.: From the Editor.
8. The Scottish Agricultural Gazette, published at 63 Princes Street, Edinburgh: From the Editor.
9. Note on the Agricultural Products of the Hyderabad Assigned Districts: From Government of India.

10. Records of the Agricultural College and Experimental Farm at Saidapet, by Mr. Benson: From Government of India.

11. Returns of the Railway-borne Traffic of the United Kingdom: From the Director of Agriculture.

The thanks of the Editor are recorded for all the above contributions.

RURAL ECONOMY OF SHAHABAD.

[*From the Diary of an Agriculturist.*]

SANKAR DEHRI.—(Continued.)

Sugar-cane.]—This is one of the most important crops in these places but the canes I saw were very poor looking, not over 2ft. in length and containing very little juice.

Soil.]—Heavier class of soil is better for the crop but here the ryots grow sugarcane in the little *dorus* or loam they have got.

Varieties.]—Only one variety, *viz.* *Munge*, is grown here.

Manure.]—The little they have, they put in the sugar cane fields. It consists simply of a little ash and a little burnt up and quite dry dung and these they use in such small quantities that their value is quite inappreciable. The manure is put in Aghan—Pous (October—November.)

Tillage.]—The land is watered from wells and ploughed 6 to 15 times. *Henga* is then put in followed by another ploughing. The land is then divided into furrows and *gulia* or cuttings put in and covered up by another ploughing. This is done in Falgoon (February—March). The cuttings are put in horizontally, about 3000 in a bigha or one-third of an acre. Henga is next put in and the field is irrigated once in every fortnight till it begins to rain, namely 6 to 7 times altogether. After each irrigation, the land is hoed by a *Kodali* or spade three times. The cane ripens in next Pous to Falgoon (January to March). Beehea mill is used in pressing the canes, and of this, I found two at Sankar Dehri and one at Khani. The mill is hired by the poor ryots for 5 annas a day. The mill can work the canes of 10 Katthas or one-sixth of an acre in one day. This of course will depend on the nature of the yield per acre.

After the extraction of the juice, it is boiled in long shallow iron pans 3ft. to 3½ft. across. The pan is filled to a depth of 3 inches. The boiling takes about 4 hours. The fuel used is simply the leaves and the refuse of the canes after the extraction of the juice. When the juice becomes sufficiently thick by boiling, the pan is removed and the thick juice taken out of the pan by a *khuri* or ladle and a wooden stirrer called *dopatan* to a bamboo basket to solidify. One pan holds about 4 *gharas* or jugs of juice which when boiled down gives one basket *chaki*, that is, 3 to 4 *pashari* of *gur*. When boiling the scum is removed but seldom any clarifying substance added. A little *gur* is sometimes prepared with extra care for family use, when milk is used to clarify. No care is taken to keep the utensils and juice clean. Dirt even seems to be purposely mixed to increase the yield. A little inferior sugar is also made by bleaching the *gur* by *vallisnaria* (shewal). The usual market to sell the *gur* is Jagadishpore, 84 miles from Sankar Dehri. From Jagadishpore, *gur* is taken to other places by rails People of villages a little to the south of Sankar Dehri sell their *gur* to the Hindustani sugar-manufacturers of Nasrigunj.

Sugar-cane is sometimes attacked by insects which eat up all the juice of the lower portion of the stem.

NASRIGANJ.

The mouza of Nasrigunj includes two small towns, *viz.*, Nasrigunj and Hariharguuj. Both these places are Government Estates. Hariharguuj is to the east of Nasriganj, and both are situated on the river Sone which passes by the south of Nasrigunj and south and east of Hariharguuj. The people are mostly tradesmen. Sugar-refining and paper-making are two very important industries in this part of the country. Sugar is refined either by the ordinary process (see pages 60-61 of the Indian Agricultural Gazette) or by the centrifugal machine worked by a turbine. The paper-making industry has considerably declined since the establishment of the paper mills at Bally and Lucknow.

Soil.]—The soil is generally sandy. From the banks of the Sone as far as the canal to the west and the Balia factory to west-north, the soil is very light and grows only barley, kusum (Carthamus tinctoris) and dhan (rice), excepting *dehi* land where wheat and poppy can be grown. There are however small patches of land of better quality. The sandy soil is generally of brown color and very coarse (almost similar to the sand I saw as far north as Sankar Dehri). The best land here is between Hariharguuj and Jamalpore, a village little lower down. Besides this there is a narrow strip of good land close to the river. On the bed of the river which is almost quite dry excepting during the rainy season, large pebbles of all shapes belonging to different rocks are found. Some pieces of quartz can easily be distinguished.

Slate is very common. The sand which is generally brown and coarse consists a'so of small round pebbles. Limestones are very common, and on the beach *kunkur* is very abundant which is collected and burnt for lime. The *dehi* land to the north of Hariharganj grows very good wheat. The land about the Balia-factory is very sandy and grows only barley, kusum and such crops. The best use to make of such lands would be to plant Sisoo, Toon, Nim, and other trees fit for timber as well as fuel of which latter there is a great want. *Karil* is a kind of black soil which when wet swells and gets sticky. It contains a large amount of decomposed vegetable matter.

People.]—The cultivators generally seem to be very painstaking and fairly intelligent. The great mistake they are making is the free use of the canal water in case of *rabi* crops, and then coming to the conclusion that canal water is only good for rice while injurious to *rabi*.

Crops.]—Barley, linseed, rahar, castor oil, paddy, kurthi, (pulse) and mothi (also a kind of pulse) are the crops generally grown on sandy soils; while wheat, sugar-cane, peas, barley, poppy, and paddy on *dorus* or loamy soil. *Karil* on the other hand grows wheat, cicer (gram), peas, khesari (pulse) and sugarcane. The crops however which are the most important factors in the rural economy of the country are paddy, sugarcane, wheat and barley.

Sugar-cane.]—The varieties of cane grown in this part of the country are *mungo, saroti, bhonrli, and pansahi.* The first is white giving best sugar, the second red, the third black, and the forth white and black both and very long. Of these four varieties, the first two are most commonly grown.

Soil.]—Dorus and karil or heavier class of soil are suited to sugar-cane growing; but the success of cane cultivation greatly depends on the manure added.

Manures.]—The manures here used are ashes, and sweepings. Cowdung is not good for sugarcane, for the juice then is poor and contains much mucilage and uncrystalizable sugar. Sheep-dung is the best.

Rotation :-

a

(1) Sugar-cane followed next year by.
(2) Kharif rice.

or (*b.*)

(1) Sugar-cane followed by.
(2) Wheat.

or (*c.*)

(1) Sugar-cane followed by.
(2) Peas.

Sugarcane can be followed by any crop but for the next sugarcane crop, the third (*c*) system of rotation is the best and the second (*b*) worst. Sometimes when cane fails on the land prepared to grow it, *castor oil* and *rahar* (Cajanus sativus) are sown broad cast. As a border or edge *patua* is sown.

or (*d.*)

(1) Sugar-cane followed by.
(2) Shama.

Tillage.]—Ploughing begins in Asarh (July) and is continued till Falgoon (February-March), when sugar-cane cuttings called *gulia* are planted. Altogether the land receives ten to twelve ploughings. After each ploughing *henga* is applied. The manure is put in after the third or fourth ploughing but also in January and February. The cuttings are planted in the open furrow and covered by another ploughing. Then sheep are folded in the night time. Planting begins in February and is continued till April. In one bigha, that is, one-third acre of good land 6,000 *gulias* are planted; more on inferior lands After planting, the land is irrigated as soon as possible and then hoed by a *kodali* or spade. After each irrigation, the land is hoed two or three times. Irrigation is continued at intervals, till the rain commences. Altogether some four to six irrigations are necessary. Well water is thought to be better than canal water for irrigation.

Harvesting.]—The canes take one full year to ripen. If they are planted in one February or March, next February or March they are harvested. The canes are cut by hook, and the leaves are removed by hand of which the green ones are given to the cattle and the rest used as fuel.

Crushing etc.]—Behea mills are used for crushing the canes. One mill crushes the produce of 2 katthas or one-thirtieth of an acre of good crop and 10 katthas or one-sixth of an acre of worst crop. One mill costs about Rs 85 to Rs 90; it can however be got on hire at the rate of six annas per day. In crushing, one man drives the bullock, a boy feeds the mill and one man attends to the juice pan. In one iron pan 5 or 6 *gharas* of the juice are put. This yields one *chaki* of *gur* weighing about 5 or 6 *kaccha pashari.* The boiling takes two hours and one more hour is required to remove to the *chaki* etc. In the beginning of the harvest season proportionately less *gur* is yielded. If *rab* be made, 1 to 1½ seer more is obtained.

RAB CULTIVATION OF RICE.

IV

In my last contribution to the Indian Agricultural Gazette on the subject of rab, I gave a full description of the experiments designed to test the value of this peculiar preparation of the seed-bed for rice, up to the stage of transplantation. It was shown how the extent of land planted out from similar areas of seed-bed varies with the different varieties of rab, and how without rab the area of seed-bed is, at best, only one-half the whole area planted out. The results of the harvest now give evidence on a different phase of the subject, *viz.*, as to whether the seedling in a given area yield a larger crop when grown on seed-beds prepared with good rab than those from seed-beds rabed with inferior material, or not rabed at all.

2. The facts elicited on the former point will show the comparative *expense* of raising seedlings per acre of rice The latter set of facts will show whether, the question of expense being put aside for the moment, the harvest results are more remunerative in the case of good than in that of poor rab or no rab. Lastly, it will be necessary to collate the results to show the net advantage of good over poor rab or no rab.

3. I would notice the great intricacy of these experiments. Though every attempt was made to make the condition of each plot in each set of plots as equal as possible, save and except the character of the rab, there are many disturbing elements. I may emunerate some—

First.—The smallness of the seed-beds makes deductions less safe; but, on the other hand, if it had been attempted to make them larger, other more disturbing elements would have crept in. With small seed-beds it is possible to equalize more nearly the character of the soil and the facilities for retaining water.

Secondly.—The regularity of planting out the seedlings varies to a certain extent with the skill and perhaps with the whim of the planters. The distance apart also varies with the depth of the water covering the surface of the land. The number of seedlings put into each hole varies with the size and condition of the seedlings. In spite of great care in selecting the land, variations on the first two heads could not be avoided. I could not do the work with two or three men; otherwise I could not have been present during the whole process. The depth of water did vary occasionally also, but it may be noted that, on the other hand, the smallness of the areas selected reduced this disturbing element to the minimum. The variation on the last head is right and proper. The better grown the seedlings the less the number required.

Thirdly.—The previous treatment of the land used introduces a third disturbing element, and one of considerable consequence.

In Igatpuri, for instance, all the land used as seed-bed had been yearly fertilized by folding sheep. It was a customary seed-bed. It cannot be argued that the effects of previous treatment do not go a considerable way towards equalizing the results.

Fourthly.—The ingredients of the same kind of rab in different places vary considerably. These and other variations must tell on comparative results.

4. I shall while giving the results point out carefully, as far as possible, how these distributing elements come in, and must claim that it cannot be expected that the results are sufficiently accurate to permit of *close* deductions. All that is possible is a general opinion which may establish broad facts and which may give ground for the shape which continued experiments shall be made to take.

The plots were reaped on the following dates:—

Khadkala.—29th October 1885. An inferior and early ripening variety.

Karjat.—2nd November.

Igatpuri.—4th November.

Lanauli.—18th November. The reaping was retarded by rainfall after the 8th November, on which date the rice would otherwise have been cut.

The rice was in each case left two days to dry in the field, and was then carefully removed plot by plot to the prepared threshing floor. Extreme care was taken that no mixing should occur, and I have reason to believe that the care was sufficient.

5. I have thrown all the results into one table, which is appended (Table No. I). In order that there may be a comparison (not too close I must again urge) between the results in different places where soil, kind of rice, rainfall and the like differ, I have taken the outturn of the admittedly superior variety of rab—cowdung rab—as the standard. As regards area of seed-bed, I for convenience take the area shown by the cowdung rab as unity, and show the other areas proportionately. On the other hand, as regards the actual yield, I take that of the cow-

dung plots as 100 and represent the rest proportionately. In the former case the larger the area. the greater the expense of preparing the seed-bed. In the latter the larger the figure the better the harvest result. The net economic result thus varies inversely as the area of seed-bed, but directly as the yield.

6. The local *ser* varies in each place, and therefore very careful tests were made to ascertain the weight of the rice in husk representing the contents of the *ser*. I sought to ascertain whether the character of the rab had any influence on the weight of the contents of the *ser* measure, but came to the conclusion that whatever differences were shown were due to the manner in which the measure was filled, and not to any intrinsic lightness or heaviness of the grain. An average, therefore, of all the results in each place was taken to represent the weight of the *ser*, filled with the paddy of the particular variety of the experiment. All the paddy was measured as soon as the threshing was done. The loss by shrinkage from drying is being tested, but does not affect the comparative results here shown.

It was important also to test the proportion of grain and husk after samples of each kind of rice from each kind of rab were pounded. The tests taken tended to show variations, but so small and so irregular as to prove that they were not due to the character of the rab. With *Sukhwar* rice (Igatpuri) the average percentage of clean rice was 70½, with *Kolamba* rice (Karjat) the average was 75, and with *Sal* rice (Khadkala) 74½. The percentage thus varies with the kind of rice. Cowdung rab showed in one case a superiority in this respect of 1½ per cent. over "no rab", and in two others an inferiority of 0·15 and 0·10 per cent. respectively. Other exactly similar examples could be given. But they are unnecessay. The experiments can give no support to any claim of superiority in the proportion of clean rice in the grain in the case of good rabs over inferior ones, or over the produce of unrabed seedlings.

7. The table (No. 1) gives all the results in one view, save and except the *cost*.

8. The reader must now refer to, or be reminded of the remarks made as to the general conditions of each site selected.

The Karjat land had never been used as a seed-bed for rice. The land had therefore never been manured for many years (at least 30 years).

On the other hand, the Igatpuri land had for several years past been used as a regular seed-bed for kacha rab, *i. e.*, sheep had been yearly folded on it, and no doubt its fertility had been greatly increased; and though the condition of all the plots was the same, it does not require much argument to prove that the differences between the well-manured plots and those less well-manured for the purposes of the experiment would be less accentuated in Igatpuri than in Karjat.

In Lanauli and Khadkala also the seed-beds are customary seed-beds, but the seed-beds there are not enriched usually by sheep folding, but are merely the spots selected yearly for burning rab. The unexhausted manure from burnt material is naturally less than that of unburnt, as was the case in Igatpuri. It may be said that the *manurial* value of the rab burnt is all exhausted in the one year. The burnt manure is assimilated by the plants.

9. These facts go to explain the very large percentage of yield in the unrabed plots at Igatpuri as compared with the other places. There is, indeed, very little difference between the plots, while at Karjat the unrabed plots yielded a miserable return. At Lanauli the addition of pit manure and at Khadkala of cowdung raised the yield considerably, but still left it much below that of approved rab plots.

In Khadkala the very striking difference between the yield of the plot *rabed* with cowdung and the plot *manured* merely with an equal amount must not escape notice. Pit manure is very inferior, as the result at Lanauli shows.

10. The next most striking feature is the great success of the sheep-folded plots. The yield both at Igatpuri and Khadkala is very nearly as high as the standard plot of cowdung rab. On the other hand, the area of seed-bed shows a very high proportion, and when cost comes to be discussed, this kind of rab will fall very low in the scale of choice. Sheep do not thrive in the districts of heavy rainfall where rab is most practised. At Igatpuri they are intercepted by the people on their way to the Bombay market.

11. The startling result of the Lanauli grass plot, I cannot satisfactorily explain. Both as regards the smallness of the proportion of seed-bed and the largeness of yield, the results are out of all proportion, considering that a large amount of grass was used with the cowdung, ain and fungal plots. The Patil thought the results due to the superior situation of this plot, greater facilities for water and better soil. Whatever it is that has caused the result, it cannot be the foundation of any argument that grass alone can be relied on to give such results, for the figures of the leaf and grass plots at Khadkala and the Karjat would be at once a sufficient answer. The fine yield of the leaf and

grass plot at Igatpuri is remarkable, and also the smallness of the proportion of seed-bed. The superiority of this plot was noticed at the transplantation time and even before when I visited the growing crop. Setting aside these two abnormal results it may be said that the results with the use of grass and leaves do not give much encouragement to those who wish to advocate their use in lieu of the recognized kinds of rab. Leaves and grass are utilized now to the fullest possible extent as subordinate ingredients in cowdung and brushwood rab. They do not even suffice for these purposes, as is clear from the fact, already noticed, that in Igatpuri the layer of grass is not put on, because grass cannot be spared.

12. The attempt to utilize euphorbia as a substitute for the loppings, though only made in Karjat, gives little hope of success. This plant is used for hedging in stack yards and houses and the like.

The trimmings of the hedges are used as fuel. It is a very poor rab material. It dries very slowly and burns badly.

13. On the whole, therefore, the experiments tend to corroborate the opinions of the local farmers.

14. The cost of cultivation now comes up for consideration. The subject is of immense difficulty. With the data collected I believe that I am in a position to deal with it, but I must first premise that I cannot guide myself by the actual expenditure incurred. First, because I had to employ watchers, to make weighments, to deal separately with small plots and the like. These facts add to the cost, but as they do not appear in the case of actual cultivation, I am right to neglect them altogether. Again, I had often to pay much more than the market price for material and labour in order to secure both in the right quantity and at the right time. I make due allowance, therefore, for such disturbing elements.

Again, the cost of cultivation may be calculated on the supposition that all material is paid for and all labour remunerated at the rate prevailing for the locality and the season, or the calculation may be made so as to show what the actual cost to the ryot is. The latter method would be the more satisfactory; but it brings in so many additional complications that I prefer, for the sake of exhibiting *comparative* results, to select the former. Then from it I shall endeavour to deduce the actual cost to the ryot. To do this the following are the elements of uncertainty and difficulty :—First, the area which can be cultivated by an ordinary ryot; next the share of his own support and that of his cattle, which should be debited against that area.

15. Each locality must be discussed separately, but as similar operations were carried out at each place with local variations it will also be necessary to show the cost of each stage of the experiment at each place, and the cause of differences.

16. I have just received the reports of the experiment at Alibag. Here all the figures are worked out by a gentleman who is a large land-holder, and vouched for by the Assistant Collector and Mamlatdar, who exercised a strict supervision. I shall use these figures in illustration of those independently worked out by me from the careful notes recorded during the last 18 months through which the experiments have extended.

I.—Preparation of Seed-bed.

17. As a rule, the seed-bed is not touched till the rab materials have been spread. In Lanauli, however, the field chosen for seed-bed was ploughed. The plough was followed by the *petari* or leveller and this implement by a clod-crusher. Seed-beds are necessarily made on high land, and so seldom is the whole area of a field suitable. Yet all the operations named must be carried out on the whole area of the field. I apportion the cost, however, only on the actual area of seed-bed, because the preparation is not carried out so thoroughly every year, and because a large area of the field at Lanauli could have been utilized as seed-bed.

The partial ploughing or breaking up of the land is done at the rate of about ⅛ acre a day by one man with one pair of oxen. Hire rate 10 annas a day.

The *petari* drawn by one pair works more slowly. The rate of hire is the same. It fills up hollows, and draws the excess earth collected in its journey to the embankments for their repair. The clod-crusher or log-harrow—*maind*—covers twice the ground covered by the plough in the same time.

Abstract cost per *guntha* :—

	A.	P.
Ploughing	0	6
Levelling	0	9
Clod-crushing	0	3
	1	6

II.—*Cost of Materials.*

A.—BURNT VARIETIES OF RAB.

(1) Cowdung Rab.

Abstract Cost of Cowdung Rab per guntha of seed-bed.

	1st layer. Rs. A. P.	2nd layer. Rs. A. P.	3rd layer. Rs. A. P.	4th layer. Rs. A. P.	Total. Rs. A. P.
Lanauli	2 13 6	1 8 0	0 7 2	0 4 0	5 0 8
Khadkala	4 0 0	1 8 0	0 9 0	0 7 4	6 8 4
Igatpuri	6 0 0	...	...	...	6 0 0
Karjat	2 4 0	1 0 0	...	0 2 0	3 6 0

In Karjat fresh dung was used. In Lanauli dung which had air-dried in the heap, but had not been exposed to rain. In Igatpuri cakes of cowdung, such as are used for fuel, were bought. Lastly, in Khadkala cakes broken up by hand, and ready for the seed-bed, were secured. The price according to weight would thus, if other conditions were the same, be highest at Khadkala and lowest at Karjat. Apart, however, from the state in which the material was available, it must be noted that all rab materials are much more plentiful at Karjat than elsewhere and so cheaper.

1*st layer.*—The cost of this layer at each place fairly illustrates the comparative scarcity or otherwise of rab materials. In Igatpuri not only are these materials scarce, but as no accessories or covering layers over the cowdung are customary, the amount used calculated as well-dried dung is much larger than elsewhere.

2*nd layar* (*grass*).—Absent at Igatpuri.—Coarse grass (chiefly *Kandar*) is one of the most suitable for this layer. It is more expensive than fine grass (*Karda* chiefly). Besides this cause for variation in price, the general considerations of scarcity of material come in. *Kandar* grass costs Re. 1 per 100 bundles (108 lbs.) at Lanauli and Re. 1 per 4 head-loads (144 lbs.) at Khadkala. *Karda* grass obtained at 330 lbs. per rupee at Lanauli, and 322 lbs per rupee at Igatpuri. It is very cheap at Karjat, *viz.*, 1,472 lbs. per rupee.

3rd layer (straw) Absent in Karjat and Igatpuri. Some light material as nachni straw well broken up is used (Lanauli), or else bruised rice and other straw mixed with leavings of cattle and light refuse (Khadkala).

4th or top layer—of earth and pit manure mixed. This layer absent at Igatpuri, and of earth only at Karjat. At Lanauli the price of pit manure came to 2,000 lbs per rupee; at Khadkala it was dearer—1,100 lbs per rupee. The earth costs only the labour of digging close by, sifting and mixing with the pit manure and spreading. This work I take to cost 1 anna per plot.

(2). AIN RAB (Terminalia tomentosa).

Abstract Cost per guntha of seed-bed.

	1st layer. Rs. A. P.	2nd layer. Rs. A. P.	3rd layer. Rs. A. P.	Top layer. Rs. A. P.	Total. Rs. A. P.
Lanauli	3 2 0	5 0 0	0 14 4	0 8 0	9 8 4
Khadkala	3 0 0	1 8 0	0 9 0	0 14 8	5 15 8
Karjat	2 8 0	1 0 0	...	0 2 0	3 10 0

There is no way of making a satisfactory estimate as to the value of the material. It is not sold and bought. After consideration, and taking into account the scarcity of the material in places, I have decided to value a head-load, *i. e.*, as much as a man can carry with the help of the *baila*, or carrying pole.

The cost of cutting, carrying, and spreading may be taken at the same rates, for the distance is smallest at Karjat.

(3). FANGAL (Pogostemom purpuricaulis).

Abstract Cost per guntha of seed-bed.

	1st layer. Rs. A. P.	2nd layer. Rs. A. P.	3rd layer. Rs. A. P.	Top layer. Rs. A. P.	Total. Rs. A. P.
Lanauli	2 6 6	5 8 0	0 14 4	0 8 0	9 4 10
Khadkala	2 10 0	1 8 0	0 9 0	0 14 8	5 9 8
Igatpuri	2 8 0	0 6 10	...	0 4 0	2 13 10
Karjat	2 1 4	1 0 0	...	0 2 0	3 3 4

The same difficulty arises as to the valuation of the material. I fix on 9 pies per head-load at Lanauli, Igatpuri and Khadkala, and 4 pies at Karjat. The cost of cutting, carriug and spreading is the same as that for ain loppings.

The high price at Lanauli has been explained.

The low price at Igatpuri is only due to the smallness of the weight used—an evidence of the scarcity of grass. Another evidence is its absence in cowdung rab. It would have been wiser if I had cut my coat according to my cloth in the ain and fangal plots at Lanauli, instead of putting on the large amount of costly grass which I was advised to use.

(4). LEAF RAB WITH PIT MANURE.

Dead leaves were collected free. A value must be fixed; say 3 pies per large basket.

	A.	P.
Lenauli, 17 baskets	4	3
Cost of collection and carrying ...	8	0
Cost of pit manure	2	6
Digging, sifting and mixing earth and spreading materials	1	0
	15	9

	Rs.	A.	P.
Or per guntha of seed-bed ...	1	15	6

(5). GRASS RAB (Lanauli).

	Rs.	A.	P.
Coarse grass *(Kandar)* ...	3	0	0
Fine grass *(Karda)*	0	8	0
Digging earth, &c.	0	1	0
	3.	9	0
Or per guntha of seed-bed...	7	2	0

(6). LEAF AND GRASS RAB.

Abstract Cost per guntha of Leaf and Grass Rab.

	Leaf layer. Rs. A. P.	Grass layer. Rs. A. P.	Top layer. Rs. A. P.	Total. Rs. A. P.
Khadkala . . .	0 15 0	3 0 0	· · ·	3 15 0
Igatpuri	1 10 6	2 5 6	0 2 0	4 2 0
Karjat	0 6 0	1 8 0	0 2 0	2 0 0

(7). EUPHORBIA RAB (Karjat).

Material has no value. Cost of cutting, carrying and spreading, about 3 pies per head-load,—

	Rs.	A.	P.
56 head-loads	0	14	0
Grass and earth layer as in cowdung rab	0	9	0
	1	7	0
Or per guntha of seed-bed..	2	14	0

B.—UNBURNT VARIETIES OF RAB.

(8). Unrabed, but manured Plots.

I have all the plots dug with the pick and then levelled after weathering. I have no proof that this stirring up of the soil did any good. It was against local advice. Next year the value of the digging may be estimated. I think it is fairer now to omit the cost incurred.

	Rs.	A.	P.
Lanauli, cost of pit manure ...	0	5	0
Khadkala, cost of cowdung ...	2	0	0

At Karjat and Igatpuri no manure was put on. Therefore cost nil.

Abstract Cost per guntha of Seed-bed of unmanured and manured, but unburnt plots.

	Manure		Cost Rs.	A.	P.
Lanauli	Pit manure	...	0	10	0
Khadkala.	Cowdung	...	4	0	0
Karjat ...	Nil	...	Nil		
Igatpuri	Do.	...	Do.		

(9). KACHA RAB (seed-bed prepared by folding sheep).

	Rs.	A.	P.
Khadkala, 20 sheep folded for 7 days at 4 annas a day	1	12	0
Igatpuri, 75 sheep folded for 4 nights at 4 annas a night	1	0	0

Or 3-8-0 and 2-0-0 respectively at the two places per *guntha*.

18. The next point is the cost of seeds, sowing and covering up the seed. There are slight variations in the practice in different localities. In some the seed is ploughed in, in others it is harrowed in. In others, again, it is raked in by the hand-rake. On the hole the variation in cost is not worth taking into account. The seed-bed is also always weeded.

A man and one pair can easily plough or harrow 20 gunthas of seed-bed in a day.

The rate of hire is high at this season—about Re. 1 per day. The cost of raking, weeding and the like may be taken to be Re. 1 also. I place the cost of covering the seed approximately at 3 annas per *guntha* of seed-bed.

The cost of seed varies—

Lanauli.—3 *sers*, or 6 lbs., at 1 anna per *ser* per plot, or 6 annas per *guntha*.

Khadkala.—Cost 3½ annas per polt, or 6 annas 6 pies per *guntha*.

Igatpuri as at Lanauli.

Karjat.—Here only 4 lbs. to the plot were used in cowdung rab. But as I have eliminated the variation in the seeding by a proportionate decrease in the area of transplantation, the variation need not be allowed to cause further complication. Cost per plot 2 annas, or per *guntha* 4 annas.

19. Cost of the *ukhalni* or breaking up the area not seed-bed. This operation is done with the plough at a busy season as soon as the rain has softened the ground. About 20 *gunthas* can be covered in a day and a half. Hire rate Re. 1 per diem, cost per *guntha* 1 anna 3 pies.

20. Lifting and transplanting seedlings. In Thana a woman is paid one full meal and 4 *sers* of paddy for lifting and planting out the seedlings grown on one *orki* (about ½ *guntha*) of seed-bed. The meal is worth about one anna and the 4 *sers* of paddy 2 annas. The cost would, therefore, be 9 annas per *guntha* of seed-bed. It cost me more than double this sum. In Khadkala it is reported that women are paid by the day 3 annas for their work, and that one woman can lift and plant out the seed-lings from ¼ of a *guntha* in a day. This would cost about 12 annas per *guntha* of seed-bed.

21. Taking roughly 7 gunthas of seed-bed to the acre, the cost of pulling and planting would be from Rs. 4 to 5 per acre. I actually paid over Rs. 11 in Lanauli. I think that the safest figure to select is Rs. 4 per acre.

22. Concurrently with this operation the *chikhaltas*, or the preparation of the land including seed-bed for reception of seedlings, is carried on. The plough drawn by one pair of oxen is followed by the *alwat*, or board harrow, to level the land. The two implements, one following the other, cover about the same ground—20 *gunthas* in a day. The hire rates are 1 Re. a piece, or the cost may be taken as Rs. 4 per acre.

23. Weeding during the growth of the plant is not always performed. The land is flooded to kill weeds as soon as the seedlings have taken root. If the rain is not timely, weeding is advisable. It is only possible to insert an approximate figure, say Re. 1 per acre.

24. Reaping and carrying the crops to the threshing floor. The cost is close upon Rs. 4 per acre, and will not vary with different kinds of rab to an appreciable extent. I suppose that 8 men reap an acre in one day, and that as many will be required to carry the crop. It is always taken to the village, often a long distance.

25. Threshing and winnowing the crop. I have by using the data collected during the experiments estimated this cost at 3 annas per 100 lbs. of paddy. It is reported that 8 men can thresh and winnow a khandi of 2,000 lbs. of paddy a day paid 4 annas a piece. This would make the cost about 1¼ annas per 100 lbs. I will reduce my figure to 2 annas per 100 lb.

26. It is presumed that a man cultivating nothing but rice land, and growing early and late rices, can with one pair of cattle cultivate 5 acres, hiring labour as is customary for weeding and for the busy seasons of lifting and planting out the seedlings and reaping. Such a man has the whole of the fair season to collect his rab material. He uses whatever portion of his cowdung that is not required for domestic purposes for cowdung rab. He is presumed to own or have the usufruct of a small area of grass land (*khap*) for the production of the grass layers. He either obtains his *tahal* or loppings from Government land free, or supplements the small amount grown in the *khap* or *sindad* land with *tahal* from Government land. He obtains wood for ploughs and other agricultural and domestic purposes free of cost, cutting and carrying it himself. He grazes his cattle on his *khap* land or in *gurchran* (communal grazing), and perhaps pays a small fee of 4 annas per head of cattle for grazing in months when otherwise it is not available free of cost.

27. In busy seasons he feeds his cattle with a little oil-cake which he buys and for the rest of the season he feeds them on rice straw, the produce of his own rice land, when they are not out grazing. The cost of the cattle feed would, therefore, be about the portion of the rice straw which is available for fodder. Some is used for the straw layer of his seed-beds. If this estimate of the cost of keep of his cattle is carefully considered, as it has been, in further detail, it will appear to be reasonable. With one pair of plough cattle the rayat would easily do the preparation of the seed-bed, and the *ukhalni*. There is plenty of time for the latter after seed has been sown and before the seedlings are ready for transplantation. The interval is about one month. The area to be ploughed or broken up is the area not seed-bed; and taking the seed-beds on the average at 7 *gunthas* per acre, which is the average shown for the ordinary varieties of rab, this area will be 5×33=165 *gunthas*, or about 4 acres. Taking into account the days on which owing to heavy rain ploughing is not possible, it is clear that the rayat can easily cover the 4 acres in one month. The most important operation in the consideration of the question now before me, is the *chikhaltas*, or mud furrow, which is made for the area not seed-bed while the seedlings are being pulled, and for the seed-bed itself immediately after the land is cleared.

Seedlings after being pulled can with safety remain unplanted for 4 days, and perhaps are kept sometimes as long as 7 days, though this interval cannot always be allowed. The plough has to be

followed by the *alwat* or leveller. Where the rayat first takes the plough and then the *alwat*, which, when not following the plough, can easily cover twice the ground ploughed in a given time, it will not be safe to calculate on more than 10 *gunthas* per diem, so that 5 acres would take 20 days, without leaving any margin for days of excessive rain when work may be hindered. A great deal depends on the lifting being done seasonably. But 10 or 12 days between the lifting of the first and the last seedlings may be allowed. This would scarcely give the rayat time to prepare the land for the reception of the seedlings. However, it must be borne in mind that part of the rice may be, and generally is, of an early ripening variety, so that if the rayat fairly apportions the kinds of rice to his necessity, he can with ease and fair margin perform the *chikhalias* in right time. His wife and boy (I take family to consist of man and wife and boy and 1 child too young to do any work; the boy can help in watching and the like) would assist in the pulling and planting and in reaping. I deduct, therefore, the cost saved by their labour and reduce the cost of lifting and planting out and that of reaping and carrying by Re. 1 per acre each, which seems fair. I allow the full charge of Re. 1 per acre for weeding, because it is quite reasonable to suppose that the rayat would have to hire labour for that work.

29. As regards threshing and winnowing, the work may be done leisurely, and is done so, and no cost need be admitted on this head.

Next comes the question of feed of family. The accepted calculation is 1½ lbs. per adult, 1 lbs. per child, of grain. The rayat would not eat clean rice all the year. He would, in fact, only eat it at busy times, exchanging his rice for nachni or other cheaper grain for general use. On the other hand, he would require condiments and pulse. Taking 5 lbs. a day for the family of clean rice, the amount per annum would be 1,825 lbs., which is about equivalent to 2,450 lbs. of paddy. Taking the price at 50 lbs. per rupee—part being early cheap rice and part being late dear rice—the yearly cost would be Rs. 50. I think this sum would cover not only condiments and pulses, but oil and clothing. The rayat would have no other expenses. This corresponds with the calculation made in another way, *viz.*, on the supposition that such a rayat would live on Rs. 4 per mensem with his family.

30. The proportionate charge, therefore, per acre would be Rs. 10, and this figure may be charged throughout for the labour connected with growing an acre of rice, afforded by the rayat and his family.

Abstract.

Cost of seed, according to proportion of seed-bed.

„	lifting and planting ...	3 Rs. per acre.
„	reaping and carrying ...	3 „ „ „
„	weeding	1 Re. „ „
„	home labour	10 Rs., or in unrabed plots Rs. 4.
„	feed of cattle taken to be the value of average yield of straw.	

The assessment on the land, both rice land and appended *khar* (grass) and *sindad* (*tahal* growing land) would come out of the profits of cultivation.

E. C. OZANNE.

THE ONION.

THE onion (Allium cepa) belongs to the lily family which includes a large number of bulbous plants widely disseminated over the earth, but principally confined to the temperate zones. Its exact habitat is unknown. On the Eastern continent it grows in its greatest perfection in the warm countries of Egypt, Spain and Portugal; but in the United States it is found to succeed best in more northern latitudes. In the colder portion it has been found necessary to shorten its season of maturity by originating early and vigorous varieties, and to stimulate them into as rapid and healthy growth as possible, and this may be accomplished by selecting from year to year those onions which mature first and sowing their seeds.

Varieties. The first requisite for success in growing onions from the seeds is to get the variety best adapted to the locality in which it is to be cultivated and also seeds of the best quality. A neglect of this care may be regarded as the first cause of failure in cultivating this plant. A variety will never reproduce itself exactly from its seeds although occasionally the differences in color are so great that one variety will be white, another red, yellow, or brown; but the most common variations relate to the shape of the bulb, some being more cylindrical, more flattened or more spherical than others. The variation which occasions the most trouble to the cultivator and requires the most skill and watchfulness to counteract, is the thick scallion, an imperfect form which onions generally have in their wild state and to which there is a natural tendency to revert. The true remedy for this difficulty must be sought in the selection of the onions to cultivate for seed.

The selection of a variety must depend upon the locality in which it is to be cultivated. For cold climates, where the seasons are short, and consequently little time is given for maturing the plant, the earliest varieties should be chosen. In warm climates where the seasons are longer, later varieties may be grown.

Raising seeds.]—To keep a variety from deterioration by running to scallions or becoming imperfect in the shape of the bulb or too late, the largest and most perfect bulbs should be selected annually for seed. The qualities most to be desired are early maturity, thin necks, and tops that wither down to the surface of the bulbs, thus avoiding late growing onions and the scallion form as much as possible. By persistence in this course from year to year, early varieties or late, globular form or flat may be produced at pleasure.

As soon as the seed capsules begin to turn brown and show signs of opening, the heads may be cut off about six inches below the top of the stalks and tied up in small bunches or spread on a floor or lattice work in a dry or airy place till dry enough to be beaten out, after which the seeds should be cleaned, and put in small bags or boxes and be kept in a dry and moderately cool place till wanted for use.

What seeds should be sown.]—Only the newest and freshest seeds should be sown. Experienced cultivators of the onion say that the seeds will not retain the power of vigorous growth more than one year. A vigorous plant can be only grown from a healthy seed; hence the necessity of sowing seeds of the previous year's growth. Thus germinating power should always be tested before sowing. This may be done by planting a few seeds in a hot-bed or in a box of earth kept in a moderately cool room in the house. If only a short time is allowed, they may be placed in moistened cotton or moss in which they will begin to grow in three or four days if of good quality.

The largest and heaviest seeds produce the best and largest onions and should be carefully separated by a sieve from the small ones before sowing. Their weight may be tested by immersion in water and drying them in the sun as soon as possible. The light seeds will rise to the surface and the heavy ones, fit for sowing, will sink to the bottom.

These principles are of fundamental importance, and if adopted and practised from year to year will prevent, in a great measure, the deterioration of varieties, which is so much complained of and frequently so little understood.

The soil.]—New land is not favourable to the growth of the onion. It should be cultivated at least two years with some other crop as corn followed by potatoes or any other bulbous crop. If a proper amount of manure is applied yearly, onion may be cultivated many years on the same land with decided advantage. Notwithstanding the cultivation of onion being difficult, it is asserted that pieces of ground in Scotland and elsewhere are known to have been cultivated with the onion from 75 to 100 years in succession without any deterioration of the crop.

Soils are scarcely ever rich enough naturally for this plant, and hence liberal quantities of manure must be applied. Too much is very rarely used—generally too little. The same piece of land that will produce 5 hundred maunds of onion by common manuring may be made to yield 8 or 9 hundred maunds by a generous dressing with the materials which the nature of the plant requires for rapid growth. This principle is of first importance and if a man will not manure his ground highly he need not except to become a successful onion grower.

Organic elements of the onion.]—"The bulb" says a distinguished chemist, "contains much sugar, gum, and mucilage, a considerable quantity of albumen, and other protein compounds, and an acrid, volatile essential oil which may be obtained by distilling onions with water. This volatile oil is distinguished from other essential oils by a most penetrating smell and by a large proportion of sulphur, which enters into the composition. Few essential oils contain sulphur, and the essential oils of onion, of garlic and of mustard, which all contain much sulphur, thus differ from most others, which consist generally of carbon and hydrogen or carbon, hydrogen and oxygen.

The composition of the essential oil of the onion consists, by weight, of about six parts of carbon, five parts of hydrogen and largely of sulphur, but the parts of the latter have not yet been determined.

It has been known that carbon, oxygen and nitrogen are found in large quantities, and therefore must form an important part of the different manures employed in its cultivation.

According to the best medical authority it increases the appetite, promotes digestion, when taken in moderate quantities and is often used with good effect in colds and dropsical affections.

Inorganic elements.]—It is found from inorganic elements of the plants that forty-five parts, or nearly one-half, of the ashes of the bulb are potash and lime, and twenty-seven parts contain phosphoric acid. Only four parts contain chloride of sodium or common salt. A soil, therefore, best

adapted to the growth of the onion, must contain not only carbon, oxygen and nitrogen which are found in abundance in the organic parts of the bulb, but also large quantities of potash, lime and phosphates, which are contained in the ashes or inorganic parts. These substances must be supplied by manures when not found in sufficient quantities in the soil.

Manures].—The manures most commonly employed in cultivating the onion are cow-manure, horse-manure, hog-manure, poudrette, guano, bones, wood-ashes, and sea-weeds. A review of the organic and inorganic substances of the onion shows that carbon, oxygen and nitrogen, potash, lime and phosphorus form the principal parts.

Peruvian guano contains the largest amount of nitrogen and phosphates of any of the manures in the list, and poudrette ranks next. Consequently they are the most powerful fertilizers. Hen-manure is similar in its composition to guano and may be used with good results. Wood-ashes contain great quantities of lime and potash, which enter largely into the onion, and on this account and because they help to decompose the organic substances in the earth and to liberate carbonic acid, are excellent manures. Bones contain about fifty per cent of phosphate of lime and forty-three per cent of animal matter which abounds in nitrogen, and when ground to a fine powder make a powerful fertilizer for the onion. Sea-wood also contains phosphates in considerable quantity, and makes an excellent fertilizer when applied in a decomposed state, or after having been burned to ashes. Horse-manure contains more nitrogen and phosphates than cow-manure and is regarded by many growers as better for the onion; but, unless it is kept from heating by keeping it cool and wet or by mixing it with cow-dung or soil, the nitrogen is expelled in the form of ammonia and it becomes almost worthless. Cow-manure contains all the elements necessary for the growth of the onion, and good crops can be raised from this manure alone; but the earthy portions are so small in quantity that an extra crop cannot be grown in common soils without the additon of some other manure, as wood-ashes, guano, bone etc., which contain large quantities of phosphates, potash, nitrogen and sulphur which from so large a part of the onion. Hog-manure ranks next to night-soil in the amount of nitrogen and phosphates which it contains and is consequently much superior to cow or horse-manure for plants which are large feeders like the onion.

Kind and quantity of manure].—The manure used in the culture of the onion should always be thoroughly decomposed; green manures are not at all adapted to its nature. They do not act quick enough. The kind to be employed and the quantity applied to an acre must depend upon the composition and condition of the soil selected. If the soil is of primitive origin, having been formed principally from the disintegration of granite and gneiss rocks, manures containing lime, potash and phosphates, in part, at least, would be much more necessary than on the alluvial soils and fertile river banks in which these substances abound, having been derived from the decomposition of limestone, shell and bones, which form the principal part of them. In Egypt, so famous in ancient times for its excellent onions, they have been cultivated from time immemorial in a similar soil, formed by the annual innundations of the Nile, and are among the best in the world

For common soils which have been cultivated for two years with some other crop, as they always should be, and are in a condition to produce a large quantity of corn, fine cow or horse-manure, without any fertilizer will be required to insure good crop.

Annual cultivation from the seeds.]—The time of sowing the seeds of the onion is of the first importance and a neglect to sow them early may be regarded as another cause of failure in its cultivation. The onion requires a long season for its growth, and cool and moist weather is the most favourable time for it to take firm root, and get a good start before the approach of the hot and dry weather of summer. If this opportunity is neglected no subsequent culture, however careful, will make up for it, and perfect bulbs will not be formed.

The seeds, if good, should be sown about one-third of an inch apart, in drills fourteen inches asunder, and covered half an inch deep. Four pounds of seeds are required for an acre. If the onions are five to six inches high, they need be thinned out to an inch and a half to two inches apart.

Hoeing.]—Must commence as soon as the rows of onions can be seen above ground, and before the weeds get any start. This early hoeing is indispensable to success. It should be continued through the season at intervals of about two weeks or oftener so as to keep it thoroughly clean.

Harvesting and storing.]—The proper time to harvest onions is when the tops have turned to a brown or yellow color and fallen down. They should be pulled by hand or with a wooden rake, and then allowed to remain on the ground three or four days to dry. After they are dried, if large quantities are to be stored, they may be thrown into piles and left in this condition two or three weeks.

They should be opened and allowed to dry two or three days before stormy.

Diseases of the onion.]—The onion is subject to few diseases, the fungus or smut being the only one which has caused any serious difficulty in its cultivation. The disease manifests itself in different forms, sometimes appearing in small patches in the axils or on other parts of the leaves, and finally extending and covering considerable portions of the surface with a black smut similar to that frequently seen on the ears of jowari. It is also found on the inside of the hollow leaves, turning the outside to brown or straw color and when they are opened they are found often to be filled with a black smut like that just described. It attacks the onions when they are quite small and by its gradual extension rarely fails to destroy them in a few weeks.

Remedies.]—A remedy for this disease must be sought by using less manure or using manures which are less stimulating and afford less nitrogen for the fungus to feed upon. Alkaline manures are very destructive to the fungus and may be resorted to with excellent effect to prevent its ravages. Wood-ashes, lime, gypsum, and sea-weed are very efficacious. The external application of weak solutions, as of lime or salt, or dusting with sulphur, may have some beneficial effect in destroying the fungus and invigorating the plant.

NOWROJI. M. BOMONJI.

NEWS.

UNITED PROVINCES.

The report for December 1885 on the prospects of the Wheat and Oilseed crops of is as follows:—The forecast for November, indicated a rather unfavourable opening of the wheat and oilseed season. The rains had slackened off—in fact ceased much earlier than usual; a shrinkage of th area under these crops resulted; the people were busy irrigating their fields: the prospects were fair; but it looked as if the hoped-for harvest would cost the people dear, because in many places irrigation had to be resorted to before sowing and then had to be plied hard immediately after germination. During December, however, the whole aspect changed. Clouds began to come up early in the second week of the month, and rain fell on the 11th and 12th. On the 13th the clouds seemed to be clearing away. But on the 17th they gathered again, and on the 17th and 18th there was a general fall of rain all over the provinces—in several places exceeding 2 inches. This is the first year since 1877 in which we have had such heavy Christmas rains.

The rain of December has been most timely, and its benefit can scarcely be overrated. Every seed that had life in it has germinated and the young plants have come forward vigorously. The white-ant pest has vanished with the advent of the rain. Irrigation has practically ceased everywhere. A few complaints about the "lassi" (fungus) pest damaging the rapeseed have been made, and there is reason to fear that there is, in damp localities, some ground for complaint. The pest is however not general. Abstracts of the bulletins of the reporting zamindars are appended. It will be seen from them that the present prospects of both the wheat and oilseed crops leave nothing to be desired.

CENTRAL PROVINCES.

The forecast of the outturn of the current year's linseed crop in these Provinces. The importance of the crop in the economy of the provinces may be judged of from the fact that during the year ending 31st March 1885, the exports of linseed amounted to 25 lakhs of maunds, with a value of nearly ¾ crore of rupees. The linseed exports brought into the provinces a sum sufficient to pay the whole of the Government land-revenue and leave a surplus of 11½ lakhs of rupees. The following figures indicate the proportions in which the different revenue divisions contributed to this export:—

	Lakhs Maunds.
Jabalpur	3
Narbada	2½
Nagpur	10½
Chhattisgarh	9

For the purpose of the linseed trade the Nagpur and Chhatisgarh divisions are therefore by far the most important. In the annexed table a column has been provided to show the approximate area under linseed last year in each district. It will be seen that linseed production is of most importance in the districts of Wardha, Nagpur, Chanda and Raipur. Next come the districts of Bhandara, Bilashpur in the south, and those of Damoh and Jabalpur in the north of the provinces. It may be added that a very large proportion of the linseed crop in Bhandara, Raipur, and Bilaspur is grown as a second crop after rice, and is therefore not so productive as that of other districts.

The failure of September rains affected the linseed crop very injuriously. Linseed is sown, as a rule, at the commencement of October, and September rain is therefore of the highest importance for its germination. Prospects were improved by showers which fell very generally towards the middle of October, but rain which follows the sowing of a rabi crop cannot completely compensate for a lack of moisture in the soil at sowing time. In December a heavy fall of rain occurred throughout the provinces with cloudy weather which lasted for nearly a fortnight. This was of great benefit to a large portion of the linseed crop but damaged that portion of it which had been sown early and was either in flower or coming into flower. This was unfortunately the case with a large portion of the crop in the Wardha and Nagpur districts, which are the most important linseed producers in the provinces. In the Raipur and Bilaspur districts the

December rain did unmixed good. In the four important districts of Damoh, Jabalpur, Raipur and Bilaspur a full average crop is expected. But for Wardha, Nagpur, Bhandara, and probably Chanda the estimates are not higher than 10 annas, that is to say, the outturn is expected to fall short of a full average by between 35 and 40 per cent. It should be added that cloudy weather at the end of January or beginning of February would greatly lessen the produce of those districts for which a full outturn is now anticipated.

The second report on the prospects of the Wheat Crop is as follows:—Prospects have not changed materially since submission of first forecast. The wheat crop is reported to be in favourable condition in all districts, and its principal risk of damage is now from blight; no rain has, however, fallen since the third week of December, though the weather has been rather cloudy at times. The exports of wheat up to date show an increase over those of the corresponding period of last year. The price of wheat in Raipur was in December one anna per maund less than it was in November and 5½ annas less than it was in October, this is itself an indication of favourable prospect; in Nagpur prices have risen one anna per maund since November; in Jabalpur prices are stationary.

The third report on the prospects of the Wheat Crop is as follows:—Returns have been received from only twelve out of seventeen districts; they indicate a decided deterioration of prospects owing to continuous cloudy weather, which has resulted in a good deal of rust. At the end of January slight falls of rain occurred in the Southern and Eastern districts, but these were not of so much harm as the cloudy weather which preceded and followed them. In no district from which returns have been received is more than an average outturn anticipated, and the estimates from the Southern districts range between 9 and 13 annas. The export trade has declined, and prices show signs of rising.

PANJAB.

The first report on the prospects of the Wheat Crop is as follows:—Estimated area under wheat this year 6,000,000 acres, or nineteen per cent. less than last year; decrease owing to want of rain at sowing time. Rain in December and now has greatly improved the prospects of the crop.

The report for November and December 1885 on the prospects of the Wheat Crop is as follows:—The accompanying statement gives an estimate of the area under wheat in each district in November and the prospects of the crop as recorded at the end of December. The general result is a decreased area under wheat this year on account of want of moisture at sowing time. The area of last year was 7,400,000 acres; the present sowings are estimated at only 6,000,000 acres, but it is probable that the rain, which was fairly general in December, enabled fresh sowings to be made. The prospects now are decidedly more favourable than in November.

BERARS.

The report on the prospects of the Wheat Crop for the month of February 1886 is as follows:—Estimated acreage under wheat quite up to the average which is 807,805 acres. Rain in December gave promise of an excellent crop, but in January came cloudy weather, and this, as usual, caused a blight to attack wheat and that under irrigation has specially suffered. In seven taluks a full average crop is expected, and in the remaining fifteen taluks the estimates are from 12 to 14 annas. The crop will soon be ready for reaping.

BOMBAY.

The report on the prospects of the Wheat for the month of February 1886 is as follows:—*Sind.*—Area returns incomplete, crop reported healthy and promising. *Gujrat*—corrected area for Ahmedabad 225,000 acres which brings up the whole area of Gujrat to average; crop generally healthy; no rust in Broach as was feared, but smut is prevalent in Ahmedabad. *Deccan*—revised area 1,100,000 acres or 300,000 acres above average, but rust is reported from all districts though nowhere severe; insufficiency of moisture in parts of Khandesh. *Karnatic*:—area 475,000 acres as against 350,000 acres average; condition of crop very good in spite of prevalency of rust. The type of rust this season is not severe, and present bright clear weather will probably enable the crop to recover.

The report on the prospects of the Cotton Crop the month of February 1886 is as follows:—This forecast deals with condition, not area. *Sind*—chief district Hyderabad, average 12 anna crop, in spite of some damage from boll worm; elsewhere crops poorer, but area insignificant. *Gujrat*—chief districts, Broach 9 annas, Ahmedabad 12 annas. Surat less favourable; picking commencing. *Kathiawar*—reports favourable; in the Northern tracts some injury from cloudy weather. On the whole, the Gujrat crop will be considerably heavier than last year. *Baroda*—still sends no returns. *Deccan*—Khandesh includes 95 per cent. of the Deccan area; crop uneven but much better than last year, no shedding reported; other districts, area very low and condition probably below 4 annas. *Karnatic*—Dharwar shows more improvement in condition than in area, crop backward and blight prevalent, especially in exotic variety. Bijapur, though greatly better than last year, and though crop better where largely sown, has an uneven crop. Belgaum reports blight and premature ripening.

ASSAM.

The first report on the prospects of the Mustard Crop is as follows:—Area under mustard this year is 151,850 acres against 137,587 acres last year; crop this year 14 annas against 17 annas last year. Exports in 1886-87 will be about 30,000 tons.

BRITISH BURMA.

The report on the prospects of the Rice Crop for the month of January 1886 is as follows:—The total area under cultivation in the ten surplus districts is now reported as 3,221,832 acres, or 129,884 acres more than last year. The crop has been completely reaped over the whole Province, and the area injured in consequence of the disturbances is still estimated at 16,000 acres in the Pegu district

and at about 5,000 acres in the Shwegyin district; the total loss from this cause is therefore about 21,000 acres. The cutting and threshing of the crops have confirmed the estimates of outturn made during the previous months and the estimate for Shwegyin alone is reduced from 17 to 14 annas the cultivated area of the Shwegyin district is, however, comparatively unimportant, and there is therefore no reason to alter the estimate of the exportable surplus made last month, which is maintained at 1,000,000 tons.

Prospects of the Indian Rice and Cotton Crop of Season 1885-86:—In the British Burma, the area under cultivation is believed to be 3,234,094 acres, *i. e.*, greater by 142,046 acres than that of last year. On more than half the cultivated area the crop is up to or above the average, on two-eighths of the area it is slightly below the average, and on one-eighth of the area it is poor. On the whole the crop cannot safely be estimated as more than an average one, and the exportable surplus is likely to be about 1,000,000 tons. Rice has been reaped in nearly all parts of the Province.

For the Lower Provinces of Bengal statistics are not available.

In the Central Provinces rice production is of commercial importance only in the Southern and Eastern districts. The commencement of the rainy season was favourable, and in most ditsricts the area under rice is larger than in 1884-85. The break in rains, which began at the end of August, and which lasted in many places for nearly two months, did considerable injury, and on the whole, the present harvest is not likely to yield more than a two-thirds crop.

Cotton.—The condition of the crop in the Bombay Presidency is generally favourable. The area under cotton in British Districts and Native States is estimated at about 4,170,000 acres, and it is believed that the crop will be finer than that of last year.

In the North-Western Provinces and Oudh, where cotton is grown as a mixed crop with *arhar* (Cajanus indicus), *til* (Sesamum indicum), and *urd* (Phaseolus radiatus), the area of the present season is estimated at 1,700,000 acres, or little over 800,000 acres in excess of the average of the past nine years. The report on the crop in the month of November was very favourable, the cotton having flowered profusely. The pods burst early and the fibre was of good quality, clean and silky. In the Doab, Rohilkhand, Bundalkband, and in Western Oudh over four-fifths of the crop are reported to have been gathered, and cleaning is going on briskly. The December rains may possibly have injured the final pickings. The yield of the present harvest is estimated at 40,000 tons, from which 20,000 tons of clean cotton will be available for export.

In the Central Provinces cotton is grown over a very limited area. The area under cotton is, however, large than was the case in 1884-85; the season has been, on the whole, and it is believed that the outturn will be nearly, if not quite, up to the average.

In the Berars, the area under cotton has been everywhere below that of last year, chiefly on account of the want of timely rain and the depressing effects of the previous harvest. All districts, however, promise about a three-quarter crop, and on this basis the probable outturn is estimated to be 24,500 tons, or higher by about 20 per cent than that of last year.

The prospects of the cotton crop in the Punjab are generally good, but statistics are not available.

Prospects of the Indian Wheat Crop of the Season 1885-86:—The result of the first season's (1884-85) experience of the system of reporting on the condition and prospects of the wheat crop, which was experimentally started in 1884, has been to show that in those Provinces in which the necessary machinery for the collection of statistics exists and is in good order, forecasts of very fair accuracy can be made. From Januray to May 1885 monthly memoranda were published giving detailed estimates of both area and outturn of the wheat crop. It was found, however, that the system of reporting adopted imposed in some cases an undue burden on the officials responsible for the preparation of the monthly reports without sufficient counterbalancing advantage. It has therefore been determined that for the present no return of area shall be required until the month of April, rough forecasts of the general character of the crop alone being asked for in the earlier months. The reports for the season of 1885-86 are now being received, and the following particulars as to the condition and prospects of the current wheat crop are published for general information.

In the Punjab the area under wheat is estimated at 6,000,000 acres, *i.e.*, 19 per cent. below the area of last year. The decrease is due to the want of rain at sowing time, but the rain which fell in December and January has improved the prospects of the crop which now promises well.

The cessation of the rains in the beginning of September has also caused a general diminution of, probably, not less than ten per cent, of the area usually under wheat in the North-Western Provinces and Oudh. The growth of the plant is however generally reported to be much healthier and more vigorous than was the case last year, and from later information furnished in the weekly weather and crop reports it is gathered that at present the prospects of the harvest are excellent througout the United Provinces, and that an average outturn larger than that of last year may be anticipated.

In the Central Provinces the area under wheat has been affected by the early cessation of the monsoon and the consequent drying of the ground before sowing time, but the crop is in good condition in all districts and the principal risk of injury is now from blight. The exports of wheat from the Provinces up to the end of January show an increase over those of the corresponding period of last year.

In the Bombay Presidency the area and condition of the wheat crop are satisfactory in Sind, Kathiawar, and in the Deccan and Karnatic Districts. Statistics as to area are not yet complete, but taking 100 to represent the average area of wheat cultiva- , the area under wheat in British Districts, exclusive of Sind, is 110 as compared with 117 last year. In the Native States, excluding Baroda, the area does not differ for the two years.

In the Berars the area under wheat is estimated

at 804,982 acres, which is slightly below the average. The crops are generally in excellent condition, a bumper crop is expected in four districts and a crop quite equal to, if not above, the average in the remaining two districts.

So far as can be gathered at present, the prospects and condition of the wheat crop in Central India and Rajputana are also good.

The general condition of other food-grains and non-edible crops at present on the ground is on the whole favourable. It may therefore be expected that a fairly large proportion of the wheat harvest will be available for exportation.

The following statement shows the supposed normal wheat area of each Province:—

	Acres.
Punjab	7,000,000
North-Western Provinces and Oudh	5,600,000
Central Provinces	4,000,000
Bombay	1,600,000
Berars	700,000
Rajputana	2,500,000
Central India	2,500,000
Bengal (Behar)	850,000
Hyderabad	750,000
Kashmir	500,000
Baroda	88,000
Mysore	20,000

EXTRACT.

Agriculture in the Bombay Presidency.

THE following Government Resolution on the annual report of the Director of Agriculture, Bombay Presidency, for the year 1884-85, has been issued—

Resolution.—1. The range of subjects discussed in this—the second—annual report of the Director of Agriculture is very wide. Mr. Ozanne has as far as possible given his best attention to every event directly or indirectly connected with agriculture which occurred in the Presidency in the year under report. This course is the annual result of the importance of the department, which extends over a large field of operations and makes it difficult for the Director of Agriculture to concentrate his energies, which should not be exposed to an undue strain.

2. In the improvement of statistics, which is one of the most important objects of the creation of the department, material progress has already been made. The forms suitable for the tabulation of those relating to land and agriculture in this Presidency have been settled and approved by the Government of India, and the "Manual of Revenue Accounts" is under revision. The statistics of the year under review were not tabulated in the new forms, but those of the Dharwar district were tested by the establishment of Circle inspectors, the organization of which was described in the first annual report of the Director of Agriculture, and His Excellency the Governor in Council has learned with satisfaction that greater accuracy has already been observed. In the course of the year a similar establishment was organized in the Bijapur district, but it was for the most part employed in inquiries regarding the extent to which crops had failed. The Governor in Council entirely concurs in the view of the Director of Agriculture that the District inspector and the Circle inspectors should aid in compiling the statistics which they test, and that the tendency of Mamlatdars to employ them on extraneous duties should be at once checked. It appears that a thorough examination of boundary-marks and correction of the maps will at first occupy a large proportion of the time of the establishments.

3. Mr. Ozanne states that the establishments of Circle inspectors sanctioned for the Dharwar and Bijapur districts are adequate, but that the time has come to look to the Survey Department for further aid in supervision. As regards the general question of gradually transferring to the Agricultural Department, Assistant Superintendents of Survey, no immediate decision is required and the subject is of too great importance to be disposed of in reviewing an annual Administration Report. His Excellency in Council would, however, observe that Mr. Ozanne has produced strong evidence to demonstrate the necessity for adopting his proposal. The duties which he enumerates as those which the officers transferred would have to perform are such as can not and should not be performed by Assistant Collectors. The tendency of Mr. Ozanne's proposal is simply to preserve and continue the excellent work done by the Survey and Settlement Department.

4. Separate reports on the working of the Bhadgaon and Hyderabad farms, to the re-organization of which Mr. Ozanne has given considerable attention, have been received and will be separately reviewed. His Excellency in Council learns with much satisfaction that valuable results are anticipated from the Nadiad farm, which is a private institution. The efforts of the public spirited gentlemen who are co-operating for the improvement of agriculture are very laudable, and the Government in Council trusts that their efforts will be crowned with success, and their excellent example followed in other places as the result cannot but be very beneficial to the country. The enterprise shown by Mr. Bechardcas Veharidas Dessai in assisting the measures adopted by Government and in adopting measures on his own account for improving the produc-

tion and curing of tobacco is also worthy of acknowledgment and encouragement.

It is a matter for regret that the efforts made to improve the quality of wheat by the distribution of selected seed were to a large extent frustrated. Most of the seed was damaged by weevils, while the wheat crop in the places in the Southern Maratha Country selected for experiment almost entirely failed and in the Deccan was injured by rust. A successful result was, however obtained in the Surat district. The distribution of good seed in a judicious manner will be continued, as this measure more than any other is likely to be productive of visible good results. The superiority of the bajri seed obtained by Mr. Strachan at the Hyderabad farm by a process of selection continued for several years is said to be very marked and to have attracted the attention of cultivators in the vicinity.

6. The experiment made with cotton seed picked from five lobed bolls in Dharwar has not in the opinion of the Director of Agriculture been very successful. In Government Resolution No. 7296, dated 12th September, 1884, the Collector was desired to discontinue the collection of seed except for the purpose of investigating the result of sowing four or five-lobed pods and to offer prizes for the best samples of unginned cotton. Steam-gin factories have been established at Hubli Gadag, and it may safely be assumed that the most suitable means of ginning the cotton grown in the Dharwar district, now that it has been opened up by railways, will be supplied by private enterprise. The Collector should be requested to impress on the municipalities of Hubli and Gadag the expediency in their own interests as well as in the general interests of the district of carrying out as soon as possible the projects of establishing cotton markets in these towns.

7. The remarks in paragraph 114 of the report regarding the supply of arrowroot to the Commissariat Department should be communicated to the Military Department for consideration.

8. The Director narrates in detail and with reference to Resolution of Government the course of gradual development of the means of obtaining improved agricultural statistics. This is useful and convenient for reference while the work of constitution is in progress. He also gives a summary of the discussions which have been going on in the year of report as to improving the export staples—wheat and cotton—and the utility of ensilage in regard to which latter his opinion is at variance with the conclusion reached by Government in the Military Department and must be justified by further experiment.

9. 'The report contains ample evidence of Mr. Ozanne's activity in dealing with a great number of subjects and special aptitude for the conduct of the important duties entrusted to him in starting a new department. He has adopted the proper method of careful and patient inquiry. His labours have already yielded practical results, which are indicative of what will eventually be obtained by a continued course of experiment and scientific observation. By the steady pursuit of a definite object there is a reasonable prospect of the agriculture of the Presidency being substantially improved.—*Bombay Gazette.*

STRUCTURE AND DEVELOPMENT OF TEETH.

By Professor Fream, B. Sc., F. L. S., F. G. S.

The free portion of the tooth seen in the mouth is called the *crown*, and from this there proceed one or more *fangs*, which are buried in a socket furnished partly by the jawbone and partly by the thick mucuous membrane termed the *gum*. The region at the junction of crown and fang is called the *neck*. If a tooth is sawn through, either vertically or transversely, it is seen to be not a homogeneous structure, but to consist of several different tissues enclosing a hollow interior. This latter is the *pulp cavity*, and during life it contains a soft, delicate tissue richly supplied with minute blood vessels and with nerves, the whole constituting the *dental pulp*, which, by means of a tube extending along the fang, becomes continuous with the tissue of the deeper-lying part of the gum. Hence, blood enters into, circulates among, and flows from the dental pulp; it carries in material for the growth and nourishment of the tooth, and carries away such material as is no longer needed.

The hard tissues are three—*dentine*, *enamel*, and *cement*—but the relative proportions of these vary in different kinds of animals. The dentine (or ivory) forms the chief mass of the tooth, and gives to it its general form, furnishing the entire wall of the pulp cavity. In its general appearance and composition it resembles very compact bone, but it does not possess the cavities and minute canals which are to be seen in microscopic sections of bone. Analyses have shown dentine to contain 28 per cent. of animal matter, and 72 per cent. of mineral or earthy matter (bone contains as much as 33 per cent. of animal matter). The animal matter of dentine is resolved into gelatin on boiling; most of the earthy matter is phosphate of lime, the remainder comprising carbonate of lime, phosphate of magnesia, and other salts, including a trace of

fluoride of calcium. When dentine is microscopically examined it exhibits a structure made up of innumerable, minute, parallel, wavy tubes giving off lateral branches, and so very narrow that at least five thousand would need to be placed in contact side by side to extend over one inch. These delicate tubes open on the surface of the dental pulp, the other ends branch in the region of the external surface of the dentine.

Externally the dentine has, as it were, two caps fitting upon it, the cap of the crown being enamel, and that of the fang or fangs cement. The summit of the crown is invested by a thick layer of enamel, which becomes thinner on the sides, and dies out in the rigion of the neck. Enamel is the hardest tissue in the animal body—it is harder than steel, with which it will strike fire like flint. It is thickest on the grinding surfaces of the molar teeth and on the cutting edges of the incisor teeth, these being the situations in which it is most needed. It contains only 2 per cent. of animal matter, the composition of the mineral portion being very like that of the earthy part of the dentine. If a tooth is heated sufficiently to char it, the dentine owing to its containing so much animal matter turns black, while the enamel retains its whiteness. The reader might try this experiment. In structure, as determined by the microscope, enamel consists of delicate six-sided, solid fibres set closely side by side, and nearly at right angles to the surface of the deeper-lying dentine. These fibres are, perhaps, narrower than the tubes of the dentine.

The cement (or crusta petrosa) is a thin layer of true bone which encloses the outer surfaces of the fangs and thins out on the neck. Consequently, that portion of the external surface of the dentine which is not covered by enamel is invested by cement. As age advances, the cement usually grows thicker, especially near the point of the fang, where it sometimes blocks up the orifice leading to the pulp cavity. By its connection with the surrounding membranous structures the cement helps to fix the tooth in the socket. It is, moreover, the seat of the bony outgrowths or exostoses sometimes found upon the teeth.

To make more clear the distinction between the milk dentition and the permanent dentition, let us take that which we all carry about with us; dentition simply means "tooth furniture." In the human subject the full number of milk teeth is twenty, five above and below on each side. Each five is similar to each of the other fives. Examine any one of the four sets by means of the tongue, or with the aid of a mirror, and there are found to be, commencing at the middle of the jaw and passing outwards, two *incisors* or cutting teeth, one *canine* or dog-tooth, two *pre-molars* or grinding teeth. During juvenile life all these teeth are replaced by their permanent successors, and there also appear above and below on each side, at the back of the mouth, three other teeth—that is, twelve altogether—called the true molars, which are not represented in the milk dentition. Anatomists have adopted what is termed a *dental formula* to express briefly the character of the dentition. The adult dental formula in man is :—

$$i.\ \frac{2-2}{2-2}\ ..\ c.\ \frac{1-1}{1-1}\ ..\ p.m.\ \frac{2-2}{2-2}\ ..\ m.\ \frac{3-3}{3-3} = 32.$$

which means that, of incisors (*i.*), there are two above and below on each side, of canines (*c*) one, of pre-molars (*p.m.*) two, and of molars (*m.*) three above and below on each side; and the total number of teeth in the full mouth is 32. The third and last molar is called in man the wisdom tooth, and frequently it does not come into place.

The reader will now understand the following table, which is introduced to abbreviate space. It represents the dental formula in the case of the full mouth of teeth of each animal mentioned.

	Incisors.	Canines.	Premolars.	Molars.	Total.
Man	$\frac{2-2}{2-2}$	$\frac{1-1}{1-1}$	$\frac{2-2}{2-2}$	$\frac{3-3}{3-3}$	32
Horse	$\frac{3-3}{3-3}$	$\frac{1-1}{1-1}$	$\frac{4-4}{4-4}$	$\frac{3-3}{3-3}$	44
Ox, Sheep	$\frac{0-0}{4-4}$	$\frac{0-0}{0-0}$	$\frac{3-3}{3-3}$	$\frac{3-3}{3-3}$	32
Pig	$\frac{3-3}{1-1}$	$\frac{1-1}{1-1}$	$\frac{3-3}{3-3}$	$\frac{3-3}{3-3}$	40
Dog	$\frac{3-3}{3-3}$	$\frac{1-1}{1-1}$	$\frac{4-4}{4-4}$	$\frac{2-2}{3-3}$	42

The canines or "tushes" given for the horse are rarely present in the mare, and the four premolars are frequently reduced to three by the disappearance of the little "wolf tooth," which is one of them.—*The Mark Lane Express.*

CALCUTTA MARKET REPORT

FOR THE

MONTH OF FEBRUARY 1886.

Indigo.]—There was no sale of indigo during the month of February.

Tea.]—At the public sales held on the 28th January, 8,500 packages were offered, nearly all of which

were disposed of. The tendency in prices was downwards costing over about nine annas. At the London auctions 18,600 packages of Indian tea were sold out of 20,000 offered. There was no public sale during the week ending 8th February, but at London auctions 13,500 out of 15,000 packages were sold. Prices were without any material change. On the 11th instant 9,032 out of 9,125 packages found buyers. The higher grades of tea experienced a decline of about half an anna per lb, especially for Medium Pekoes. At the London auctions 18,000 packages were offered and 15,400 sold. Prices were generally firm. During the week ending 22nd February there were no public sales in Calcutta but at the London auctions 14,100 out of 17,000 packages offered were disposed of. Prices showed no material change.

Wheat.]—During the week ending 1st February, the sales reported amounted to about 1,500 tons of Club No. 2 at Rs. 2-7-6 to Rs. 2-7-9. During the week ending 8th February, the sales aggregated to about 4,000 tons at previous prices. During the next the sales did not amount to more than 600 tons,—Club No. 2, for March delivery at Rs. 2-10; for April-May delivery Club No. 1 at Rs. 2-9-6 and Club No. 2 at Rs. 2-7-6. During the week ending 21st instant, there was a good demand for old wheat for local consumption. A few hundred tons were disposed of at Rs. 2-8 for April and for May delivery.

Oilseeds.]—During the week ending 1st instant, transactions in Linseed were restricted to about 1,500 tons at Rs. 4 to Rs. 3-15-9 for small grain, 5 per cent. refraction. During the week ending 6th instant, prices advanced fully one anna for Linseed. For April-May delivery about 3,500 tons of small grain, 5 per cent refraction changed hands at Rs. 4 to Rs. 4-1 and the quotations were Rs. 4-8 for February, Rs. 4-3-6 for March and Rs. 4-1-6 for April-May delivery. During the week ending 15th instant, about 5000 tons of Linseed were sold from Rs. 4-5 for March delivery to Rs. 4-1-6 for April-May delivery. During the succeeding week about 2,500 tons were sold. Prices for Linseed on the spot were very high. Quotations were for February delivery Rs. 4-11 to Rs. 4-12, for March delivery Rs. 4-6 to Rs. 4-6-6, for April Rs. 4-2-6 to Rs. 4-3 and for May Rs. 4-2. No transactions were reported during this month in Rapeseed or Poppyseed.

Jute.]—Very little transaction was done in this article, the advices from English Markets being of a discouraging character.

CROP AND WEATHER REPORT.

For the Week ending 10TH FEBRUARY 1886.

General Remarks.—Except in the Tanjore District of the Madras Presidency, in the Sialkot and Multan Districts of the Punjab and in British Burma the week has been practically rainless.

In Madras the standing crops are generally in good condition, and the prospects of the season are fair. In Mysore and Coorg the season promises well.

From Bombay no important change is reported in the condition of the standing crops; the *rabi* is being cut in parts of the Poona, Nasik and Dharwar Districts. In the Berars, Hyderabad, Central India, and Rajputana the prospects of the rabi continue good.

The rabi harvest continues to promise well in the North-Western Provinces and Oudh, the Punjab, and the Central Provinces, and agricultural prospects are on the whole very favourable.

In Bengal the prospects of all the cold-weather crops, including poppy in Behar and Hazaribagh, continue generally favourable; mustard and other early rabi crops and sugarcane are being harvested; transplanting of spring rice is still in progress. In Assam the crops are in good condition.

The public health continues good.

Prices shown an upward tendency in the North-Western Provinces and Oudh and in the Hissar District of the Punjab and are falling in Coorg. Elsewhere they are generally steady.

For the Week ending 17TH FEBRUARY 1886.

General Remarks.—Except in the Tanjore district of Madras and parts of the Punjab, the week has been practically rainless.

In Madras and Mysore agricultural prospects remain fair. In Coorg the threshing of rice and coffee-picking have been almost completed, and the season promises well.

In Bombay the rabi harvest is in progress in most districts of the Deccan and in parts of Bijapur and Dharwar, and prospects are good. In the Berars, Hyderabad, Central India, and Rajputana the standing crops continue in good condition.

The rabi crops in the North-Western Provinces and Oudh and the Punjab are generally in excellent condition and promise well, though in the former provinces frost and blight have done harm in some places. In the Central Provinces prospects are favourable, but some injury has been caused to the crops by frost and insects.

In Bengal the rabi crops are being cut in places with a good outturn. The spring rice is thriving and transplanting operations have nearly been finished. Gathering of opium has commenced in Gya, Sarun, and Monghyr. In Assam the mustard crop has been nearly harvested.

In British Burma the recent rain has injured the rice crop in Bassein, Shewgyin, and Thonegwa; the extent of damage in other districts is not yet known.

The public health is generally good.

Prices are rising in the North-Western Provinces and Oudh, in the Multan district of the Punjab, and in the Jubbulpore and Hoshangabad districts of the Central Provinces, and are falling in the Mysore district. Elsewhere they are generally steady.

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The climate, soil, land-tenure, and various other factors having a direct bearing on the agriculture of the vast continent of India are so very different that it is but natural to expect that the agricultural practices of the different provinces or even parts of the same province should widely vary Any one who has paid the slightest attention to the subject will not fail to see that the system of cultivation practised to raise a particular crop in his own village is perhaps quite different from that practised in his neighbouring village, and, when he comes to study the practices of different provinces, that difference becomes still more accentuated. It is also a strikingly notorious fact that while our agricultural practices are so very various, our people are sadly deficient in the knowledge of those practices, a knowledge which is of vital importance to them. Our agricultural villages are like so many islands, having very little connection with the external world. Most of the villagers live and die without ever seeing any other village beyond their own or at best a few more sorrounding ones. One of the aims of this journal is to disseminate among our agricultural population a knowledge of what their brother agriculturists practise in their respective villages, districts, or provinces. With a view to this diffusion of agricultural knowledge, we have from time to time tried to place before our readers the systems of cultivation of various parts of India, as for instance, Sugarcane cultivation of British Burma and Behar, Rab cultivation of Rice in Bombay, Potatoe and Ground-nut cultivation in Madras, Cotton cultivation in Assam, etc. We have now before us a series of very interesting notes on the agricultural procuts of the Hyderabad Assigned districts, the sum and substance of which, with the very same object of diffusion of knowledge, we beg to place before our readers.

The land in these districts is let to tenants by Government, who is the landlord of Berar. The rent is exceedingly moderate, and the soil being very productive, the necessity for adoption of improved methods of agriculture, has not been thrust on the notice of the cultivator. He can, as a rule, get from some sub-tenant twice or thrice the rent which he himself pays. This sub-letting is frequently done by men who have land, but who have also other occupations which require their undivided attention. All the best cultivated portion of Berar is where black cotton soil exists, and this soil is so productive that simple scratching and giving it seed in the most primitive fashion suffices to raise crops which keep the *kunbis* in plenty.

They have a rough style of agriculture, which beginning at the operation of breaking up fallow, may be considered the analogue of reclaiming land. At the end of the rains, when the soil is soft, they proceed to dig out the roots of any trees or bushes that may have sprung up on the land. In October they begin breaking up operations with a plough called a "*nagar*" which is a wedge-shaped piece of wood dragged by bullocks. It is made out of an angular piece of *babul* (Accacia arabica) wood, the plough

portion meeting the upright part at an angle of about 60 degrees. In the upright piece, a pole is fixed, to which the yoke of the first pair of draught bullocks is attached. By altering the position of the yoke forward or backward, a deeper or a shallower commotion is made, for one can hardly dignify the result by the name of furrow. A strong rope is secured round the upright portion and carried forward, for the purpose of attaching to it the yoke of the front and middle pair of bullocks. Each pair of bullocks has its driver, but the driver of the pair yoked to the pole guides the plough with a small piece of stick thrust in the top and back part of the upright arm of the plough.

The *nagar* is weighted with stones and drawn the long way of the field first; the clods, which it has turned up, are allowed to dry so as to be easily broken up by the cross ploughing, which is done about 20 days after the first *nagaring*. This cross ploughing breaks up all the ridges which the straggling long furrows have missed, and pulls roots of strong grass, weeds, plants and shrubs out of the ground to the surface, from which they are collected by handwork, the women and children of the cultivator doing this necessary labour. Eight or ten days after this, the *mogra* is used. This is a sort of grubber with an iron blade between the two pegs let down from the cross log, which breaks down the clods left by the *nagar* operation and separates out the smaller roots which have escaped the first operations. They only use this instrument in the long way of the field, never crossing with it. They still further clean the land by converting the mogra into a grubber. They take off the blade or iron cutting edge, and only leave two sharp pegs, called *phunta*, which tear out the roots and grass from the clods, leaving them to be easily gathered by hand. After this cleaning they get the land into the condition in which it can be worked by their ordinary agricultural implement the *bukhur*.

The land is during the rainy season worked with the "*bukhur*" ten or twelve times, to kill the grass and weeds which spring up on it; and in the following autumn a cold weather crop is sown on it, either wheat, *til*, gram or *lac* (Lathyru sativus.) These crops require richer soil than the *kharif* crops, and this is given as the reason of their being sown. We have now followed the progress of fallow land up to the point where it rejoins the general cultivated area, to a description of which it naturally leads us. The *nagar* is not employed as means of cultivating land yearly; when once the operation has been performed, it is considered that it is not necessary again for ten or twelve years for *kharif*, and once in three or four years for *rabi* crops. The people of the country consider that if it were done more frequently, the soil would become exhausted rapidly.

With regard to manure, it may be said that they are fully aware of its benefit when applied to land, and are of opinion that it will increase a crop 25 to 50 per cent., but they do not use it. There is a custom among cultivators of getting shepherds to herd their goats, sheep, etc., on their fields at night, for two, three or four nights for the sake of the manure. The cultivators say that owing to the stringent laws of sanitation, they are unable to store their manure in villages, near their own houses, and that they do not keep it outside the village, as it gets destroyed by animals and stolen by men. The substances in general use are cow-dung and ashes. The ashes of weeds and other waste materials are also used for manure.

The agricultural implements in use for ordinary cropping are as follows:—The *bukhur*, the *daura*, the *dunda*, and the *tifan*. The *bukhur* is a small *mogra* as far as its general appearance goes, but is much lighter; the two pegs of wood which go into the ground are connected with an iron knife having a sharp cutting edge which runs below the surface about 9 inches deep, loosening the soil and cutting up the weeds. This is really the plough of the Berar cultivator; for it is the implement with which he annually prepares his ordinary land for reception of the seed of the crop he intends to grow. It may be called an enormous Dutch-hoe, being so heavy as to require a pair of bullocks to draw it. The *dunda* is a small *bukhur* whose iron cutting edge is only one foot broad, and the *daura* is a still smaller variety of the same, being only nine inches broad. These are used as scarifiers of the soil between the drills of the growing crops when the land is more than usually full of weeds. After *bukhuring*, they convert the *bukhur* into a *phunta* in the same way as has been above described in the case of the *mogra*.

Almost all crops are sown by native cultivators in drills, and they have a very simple machine called a *tifan*, which they use for this purpose

It has the same general conformation as a "*bukhur*," with the exception of its having three pegs instead of two, and not having the iron plate between them. To each of these pegs or wooden teeth, a hollow bamboo is attached, which three bamboos converge to a receptacle or hopper above. These conduct the grain put in the hopper from it into the drills made by the teeth. The one used for sowing *jowari* is lighter than that used for sowing wheat; the latter has its teeth strongly shod with iron. The reason for this difference is partly because the wheat is sown when the ground is harder than it is when *jowari* is sown, and partly because the seed requires to be more deeply deposited in the cold weather to get to the moist soil than during the rains. For the wheat *tifan*, six bullocks are generally used, whereas the *jowari tifan* is drawn by a single pair. The drills are closed on the seed by means of a *bukhur* drawn after the *tifan*.

The general process of putting in *kharif* and *rabi* crops is as follows:—in March or April they begin to *bukhur* the ground, and have it accomplished three times before the monsoon breaks. Besides loosening the soil, this, as above explained, causes a disappearance of a good deal of the top soil down the fissures so prevalent in black cotton soil. After the first burst of rain, that is, during the first break, they again *bukhur* and sow cotton, or, later on in the season, *jowari*. These are their principal *kharif* crops, and on these two a rotation on the second shift is maintained. If the nature of the soil admits of it they occasionally take a *rabi* crop, especially if they see that the *kharif* crop is likely to be failure. In the Khamagaon, Chikhli, and Malkpur taluks *bajri* is much grown. The soil is of a lighter description than the *regur*, and reddish in appearace. *Bajri* is sown when *jowari* fails as a crop, in many instances. After they have sown their *kharif* crops, and that half-way house crop *til*, the seeds of which produce *gingelly* oil, they begin to prepare their land for the "*rabi*" crop.

They *bukhur* the land nine times, beginning during the rains, and the land is ready for sowing in October or November. *Lac* (Lathyrus sativus), *ulsi* or linseed, and *gram* are the first sown *rabi* crops, and wheat generally the latest. They think that the best soil should be given to this latter crop. No rotation of *rabi* crops is attempted, the cultivator's idea being that a piece of wheat land can grow wheat always and the longer the wheat is grown, the better the quality of the grain produced. Their only guide to what should be *kharif* and what *rabi* land seems to be that poorer soil will grow a *kharif* crop better than a *rabi* one. With the greater number of *bukhurings* necessary, and the larger number of cattle required to drag the "*tifan*," it is more expensive to prepare the land for *rabi* crops than for *kharif*. The smaller expense for weeding etc. necessary is a slight set off against this.

Dressing seed.—The cultivator practices a primitive dressing of seeds, such as wheat and *jowari* with cow's urine; *jowari* is also dressed with "*takla*" juice. They dress cotton seeds with a muddy preparation. Gram or *chena*, they oil with boiled oil before sowing, to prevent white ants and other insects destroying it. They use no mineral substance corresponding to the dressing with sulphate of copper in general use in England and Scotland. Of the various crops grown, we mean to give a short sketch of only a few of the most important ones, *viz*, cotton, *jowari* and wheat, beginning first of all with cotton.

Cotton.—There are five cultivated varieties of this crop; four of them are *kharif* and one a *rabi* crop. The two indigenous Berar cottons are *kharif* cottons, and are known as *jari* (or *jerri*) and *bunni*. Two imported *kharif* varieties are cultivated, *viz*., the Dharwar or acclimatized American cotton and a kind lately introduced called *Belati*-Khandesh. This latter is a very indifferent cotton. The *jari* commands the highest price in the market, and is grown on the very rich soils near Akot and Ellichpur. It pays better to grow than *bunni*; but it requires a richer, deeper soil, and is longer in maturing and very susceptible to deterioration if an unexpected fall of rain occurs when it is in the boll. It becomes yellow and discoloured by the rain. It has a long staple, and the cotton has silky feel, compared to the other varieties. Owing to this peculiarity with regard to weather, it is considered more risky as a crop than *bunni*. *Bunni* grows over the whole province, and has always been considered a first rate cotton.

Cultivation of Cotton.—The soil having been prepared as already described at the beginning of the rainy season and for some time on into the rains, they sow the cotton seed. *Jerri* cotton is sown ten to fifteen days later than *bunni*. They select the seed from the first picking of the crop, not at all from the later gather-

ings. This seed after ginning they keep carefully from damp in "*leeped*" or mud plastered baskets. They prepare it for sowing by placing it on a string-net bed (the *charpoy* common to this part of the country,) and rubbing it hard; this detaches the remaining fibres from the seeds which have escaped the ginning process; as it gets clean it passes through on to the ground. They then rub it with an admixture of earth and water, which makes the remaining fibres adhere to the surface of the seed, and when dry it can be sown evenly and escape running into clumps. They sow 20 lbs. per acre. The occasionally mix a very few seeds of *jowari* with it, in order to get the large heads of the *jowari* to roast and eat during the picking time. An almost universal rule is sowing after every twelve rows of cotton two rows of *tur* (pigeon pea) which is done to supply *dal* for the family use. The crop is sown in drills by the "*dusha*" (name of cotton sowing drill.) Five or six days after sowing, the seed springs. When the rough leaf comes on the plant then the "*daura*" or scarcifier is used between the drills. This rids the rising crop of weeds. This sacrifying process is repeated six times during the season. It is hand-weeded twice during the season, and when they think it has grown high enough it is topped, *i. e.*, the top shoot is broken off, to encourage the plant to throw out branches. This clearing process is very expensive, as is also the picking of the cotton. In the month of November picking begins, first the *belati*, and later on the other varieties, the longest in maturing being *jerri*. From *Belati*-Khandesh three or four, or even five, pickings can be obtained, while from *bunni* only two, or at most three, are got. The cotton stalks are cut for baskets, fencing, etc., and those plants which are left in the ground are torn up by the *bukhur* next year.

Jowari.—This is the great millet or *Sorghum vulgare*, and is the staple food of its class of the inhabitants of the province. More than 4,000 square miles are frequently under this crop. The cultivators recognise an immense number of varieties. *Cultivation of jowari* consists in selecting the seed from the previous crop, the largest heads being taken. This seems to be the invariable custom all over the province, but the procedure of keeping it varies. In one place these heads are beaten with a small hand-mallet, which knocks out the large heavy pickles and leaves the smaller ones adherent to the head, which is thrown, in this half-threshed condition, into the general mill. The seed is carefully kept in a basket in a dry place, with all precautions against attacks of insects, etc. The second method is that followed by persons who do not require a large quantity of seed. The heads are cut vertically into four pieces, and these carefully dried and stored in baskets until the following year. When a man requires a larger quantity, the good heads are separated as before, but they are thrown into a "*khulla*" or threshing floor and thus threshed. The grain is kept with the "*kutar*" or chaff mixed up with it until the time for sowing, when it is cleaned. It is considered essential by the people that no *chillies*, salt, *tur*, garlic or turmeric should come near this seed; as, if any of them does, its germinating properties are injured. With four seers of *jowari* seed, one seer *mung* or green *dal* is mixed at the sowing time.

The seed is dressed with cow's urine, or, in some cases, with *takla* juice. When a certain weed called *talup* appears in the fields, it is the custom to sow coriander with the *jowari*. From one and a half seers (three or four lbs) to two seers of seed per acre are sown; any time during the month of July is a suitable time for the operation. The *soil* preferred for *jowari* growing is black cotton soil. This is prepared by the cultivator during the hot weather, March and April, by two *bukhurings*. Ploughing *nagar* is not used on this land oftener than once in twenty years, as a rule. A third *bukhuring* is given in the rains previous to sowing when the weeds have spring. No manure is given as a rule but all the crops grown in the land near villages which get a small amount of manure are much finer than those grown at a distance from villages.

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The seed is deposited in the ground in drills by a three-pegged implement, somewhat of the general conformation of a *bukhur*, on which a hopper with three bamboo spouts is fixed. One pair of bullocks can draw this "*tifan*", as the seed is not so deeply deposited as wheat, and the earth is softer at the season. The drills are filled in by bush harrowing or *bukhuring* after the *tifan*. Five days after it has been sown it appears above the ground, and at a variable period of from fifteen to twenty days after that, the field is sacrified with the *daura* and this process repeated every twenty days or so (three or four times) throughout the season according to the amount of weeds. This cleans between the drills and throws up the earth on the roots of the plants. The drills themselves are hand-weeded two times during the season. When the jowari plants have attained the height

of a foot and a half, they are thinned out, a space of a foot being left between each. Just when jowari is expected to flower, the leaves of the two lower divisions of the jowari stalk are stripped off, to cause an increase in the size of the heads. This practice seems to me to have some analogy to the ring cut out of the bark of fruit-growing trees, which are inclined to grow more wood than fruit, practised in England.

Harvesting.—The crop takes nearly five months to ripen, and is reaped by male labourers, who cut down the stalks about six or seven inches above the ground. Five days after this cutting, the ears are cut off the *kurbi* or stalks by women, and men tie the straw into bundles. The ears are conveyed to a spot where it has been determined to make a threshing floor, or *khulla*; here they remain for a fortnight or so until the floor is prepared, by being trodden by bullocks and beaten with a mallet until it is quite hard. In the middle of this place a pole is fixed firmly in the earth, and in the circle, the size of which depends on the number of bullocks to be employed, the *jowari* ears are spread. Any number of bullocks up to six pairs may be fastened to the rope attached to the pole and go around in the mill treading out the corn. They are muzzled. The heads are raked (by an implement called "*dutar*") off the heap, as they become emptied of their grain. They afterwards employ a brush or broom made of *tur* stalks to remove the finer chaff which the rake misses. At the end of the day, the contents of the threshing floor are removed and subjected to a rough winnowing process (*oopana*), the grain obtained being called '*asal*,' *i. e.*, the best to be got from the specimen of *jowari*. The "*kutar*," or half-threshed chaff and heads, is again transferred to the threshing floor, and, after another treading and winnowing, a second sort of grain is obtained called "*akana*." The grain not from the third threshing and *oopana* is called "*nikana*," a very inferior description of *jowari*. It is from these two latter kinds that the thrifty *kunbi* draws his own food stores, the "*asal*" going to the market. From the four lbs. of seed the cultivator obtains on an average 420 pounds of grain, besides the *kurbi*, which is very valuable as fodder for bullocks, having a market value of four or five rupees a hundred bundles. He will obtain 125 bundles per acre. It is stacked carefully somewhere near the village.

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What grain has not been sold to the grain merchant is stored by the cultivator in *peos*, *kangees*, *baladas*, etc. A *peo* is a deep pit dug in the ground; into it is first put the "*nikana*" or worst sort of grain. Round the sides this *nikana* is put next the mats to protect the inner good grain. The best grain is put in the centre. In these pits a tremendous amount of fermentation must take place, because no insect or grub seems to be able to live in them, or destroy the grains, and the grain actually gains in weight by being kept there. When one is opened, if any person goes down into it, he is killed by the accumulated carbonic acid. They always test it with the lamp test before venturing down. The mahars of the village open and empty these pits, and get the spoilt, indifferent grain, which was put round the sides and at the bottom, for their trouble. A "*kangee*" is a small wicker house, with a thatched roof; the wicker work being well plastered with mud. There is a small door at the bottom from which they withdraw the grain. They only store grain in these which is intended for immediate use, as insects attack it in *kangees* very quickly. A *baladas* is a cellar under the house, and is also a temporary store like the *kangee*.

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Wheat.—There are three kinds of wheat grown in Berar. The best white wheat is known as *bunsi*, a hard, flinty wheat, with a fine skin, the proportion of bran to grain being small. The flour got from it makes beautifully white bread. Altogether it seems a variety of wheat worthy of being looked after. It took the third prize in the Madras Agricultural Exhibition of 1883. The second sort is known as *chauin ki khathe*; it appears to be a mixed wheat, those grains which are whitest are a shade darker than *bunsi*. The third variety is *khathe*, a red wheat, with thick coarse bran, and dark coloured flour; the bread made from it is dark in colour, and heavy. They are all bearded varieties, and grow to the height of two and a half or three feet, according to the kind of soil. Both *bunsi* and *khathe* are frequently grown as irrigated crops, but mostly as a stop gap; that is to say, that the land would be lying fallow at that time if wheat were not grown on it. Therefore it is not necessary to consider this crop in any other aspect than a *rabi* one.

* * *

Cultivation of Wheat.—The land is prepared by frequent *bukhtring*, nine or more times during the rains, and the seed is sown in November. It is put in the ground by a very deeply penetrating drilling machine, the *tifan*, which has three spikes like the *jowar tifan*, but is much heavier and more strongly shod with iron. It penetrates the ground so deeply that six bullocks are required

to pull it. On it the hopper with the three bamboo tubes, formerly described, is fixed. Wheat is sown at the rate of twenty pounds per acre, and the return from this is 450 lbs or 225 seers. In some places it is *bukhured* after the sowing drill has been used, especially when the soil is damp, to cover in the seed properly. It requires no care or weeding, and ripens in from three an a half to four months. When ripe it is in most cases cut with a *darati*, or kind of sickle; but in others is pulled up by the roots. This latter plan is only pursued in case of indifferent grain, which comes into the market very dirty and full of earth. The whole plant is thrown into the '*khulla*' or threshing place and trodden out by bullocks. The straw is so broken up and mixed with chaff that it cannot be separated; the mixture is stored and used as fodder for cattle. It is a pity that some mill of a cheap description could not be contrived which would thresh the head and separate the awns and chaff from the straw. The market value of these different specimens of wheat is as follows say: "*khathe*" or red wheat sells at 18 rupees per *kundi* (*e. i.*, 672 lbs.); "*chauwal khathe*" variety is two rupees more, or twenty rupees per *kundi*, and *bunsi* four rupees more than *khathe*, or twenty-two rupees per *kundi*.

The total amount of the external trade of Bengal with other provinces registered on the railways during the year 1884-85, as compared with the previous year shows that the gross quantity of traffic carried both ways during the past year was 24·23 per cent below that of the previous year. In the import traffic the decrease was so much as 64,58,532 maunds, or 38·20 per cent., and in the export trade 2,42,157 maunds, or 2·25 per cent. The figures of the Calcutta block showed the largest decrease, namely 43·55 per cent under imports, and 12·21 per cent under exports. In the Behar block there was a falling off of 10·60 per cent. in the import trade, and a rise of 20·96 per cent in the export trade, while the weight of goods carried to and from the Western Bengal block showed a heavy falling off of 31·61 per cent., and 56·03 per cent., respectively. Of all the staples in the import traffic, the trade in wheat showed the largest decrease, namely, 39,92,740 maunds, as compared with the preceding year. The decline under oil-seeds was also heavy, amounting to 12,90,875 maunds. The other items which showed a marked falling off were raw cotton, gram, other food-grains, and ghee, while the articles in which there was a large increase were rice, hides and opium. As regards exports, the only items which showed a noticeable improvement over the trade of the previous year were coal and salt. On the other hand, the articles which exhibited a large decrease were metals, rice, spices, timber tobacco, sugar, European piece goods, and liquors.

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The total quantity of the internal traffic of Bengal passing from one trade block to another within the province by railway during the past year, as compared with the figures of the previous year, shows that the total weight of goods registered during the past year was 14·48 per cent. below that of the preceding year. The trade of Calcutta showed a decrease of 13·69 per cent. under imports, and of 12·46 per cent. under exports, as compared with the figures of 1883-84. In Behar the decrease shown under imports was 11·71 per cent., and under exports 26·91 per cent. The import trade of Western Bengal fell off by 18·43 per cent., and the export trade by 18·73 per cent. The figures of the Eastern Bengal block showed a decrease of 30·22 per cent. under imports, and an advance of 21·02 per cent. under exports, while those of Northern Bengal rose by 4·75 per cent. under imports, and by 4·41 per cent. under exports. The net amount of traffic carried downwards and upwards during the past year was 4,40,49,887 maunds as against 5,15,11,313 maunds in the preceding year.

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Heavy rains, with extensive floods in some districts, occurred in most parts of the Australian colonies at the end of December, too late to benefit the crops, but highly beneficial to the pastures, and also valuable in filling up ponds and reservoirs, which had been dried up very generally. It has been noticed in several Australian papers that the natives had some means of anticipating the floods, as they removed their belongings from all low-lying districts, and made themselves huts on the hills. Much curiosity was felt as to how they acquired this weather wisdom, and what the signs which guided them were. The *Adelaide Observer* removes the mystery one stage :—

It is a fact worthy of the attention of Sir John Lubbock and other distinguished entomologists that the natives have arrived at their conclusions regarding the weather through observing the ants, which this year are said to have removed their habitations from the ground to the trees, with the idea of getting out of harm's way. Whether these insects have means unknown to human beings of forecasting the weather, or whether their migration to higher latitudes is merely a coincidence, is a point upon which we cannot pronounce authoritatively, but it is a fact

that the blacks have implicit faith in the prescience of the tiny creatures.

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It is said that famine threatens whole provinces of Russia; that in extensive districts the able-bodied male population have migrated *en masse* to the great towns in search of employment, and that only aged, the women, and the children have been left behind, with little prospect for many of them of living through the winter. This is directly the result of last year's bad harvest. What a pity it is that, with such a scarcity at home, Russia sent such large quantities of wheat to England, where it was like coals sent to Newcastle. If it had not been for this Russian supply, there would have been a chance of wheat rising to an approximately remunerative price before this time. It is to be borne in mind that, although the wheat crop of all Russia, was under average, it was only in portions of the southern portion of the country that it was very bad indeed, as a rule. As respects the wheat supply, Russia is pre-eminently the "dark" country.

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The St. James's Gazette thus speaks of the effects of poor crops and low prices in Russia :— We know how serious has been the effect of the fall in prices upon our own farmers, but here in England the farmers constitute a very small proportion of the whole population while Russia may practically be said to be a country of peasant proprietors. The condition of the peasantry in Ireland more nearly resembles that of the best of the Russian peasants. The peasants are deeply in arrear in respect of the annuities which they have to pay for the redemption of their lands. The taxes, even in years when prices were much higher, were collected with great difficulty, and the oppression the peasants laboured under was very great. In the nature of things, then, it will be much more difficult than ever to collect the taxes from them now, and, consequently, we may expect that the Russian Treasury will suffer more than ever this year. Apart from this is the danger of revolution in an empire where the Czar's authority rests mainly upon the peasants. Yet, in the face of all this, Russian bonds are very little under par, and sensible men predict that they will go higher still. Apparently, the capitals of Berlin have succeeded in making the German investors believe that Russian bonds are safe and profitable investment.

1. Report on the operations of the Department of Agriculture and Commerce, North-Western Provinces and Oudh, for the year ending 30th September 1885: From the Director of Agriculture, North-Western Provinces and Oudh.
2. Annual Report of the Director of Agriculture, Bombay Presidency, for 1884-85: From the Director of Agriculture, Bombay Presidency.
3. Review of the Department of Agriculture and Revenue, Central Province for 1884-85: From the Chief Commissioner, Central Provinces.
4. Report of the Agricultural Department in Assam for 1884-85: From the Chief Commissioner of Assam.
5. Report on the progress and condition of the Government Botanical Gardens, Shaharanpore and Mussoore: From the Director of Agriculture, North-Western Provinces.
6. Returns of the Railborne Traffic of Bengal during the quarter ending the 30th September 1885: From Government of Bengal.
7. Returns of the Railborne Traffic of Bengal during the year 1884-85: From Government of Bengal.
8. Report on the Riverborne Traffic of the Lower Provinces of Bengal and on the Inland Trade of Calcutta and on the Trade of Chittagong and Orissa Ports for the year 1884-85: From Government of Bengal.
9. Selections from the Records of the Office of the Financial Commissioner: From Punjab Government.
10. Journal of the Madras Agricultural Students' Association, Saidapet, for November and December 1885.
11. Memoranda of the Cotton crop and Wheat crop in the Bombay Presidency, of the Wheat crop in Berar, of the Wheat crop in the Central Provinces, of the Wheat crop in the Punjab: From Government of India.
12. Forecast of the wheat and Oilseed crops of the United Provinces: From the Department of Agriculture and Commerce, United Provinces.
13. Monthly Report of the Agri-Horticultural Society of India for the Month of February 1885: From Deputy Secretary.
14. Returns of the Railway borne Traffic of the United Provinces during the year 1884-85: From the Department of Agriculture and Commerce, United Provinces.
15. Report of the Introduction of the Tubers of the Arracacha esculent of South America: From Government of India.
16. Agricultural Gazette, London: From the Editor.

BELGIAN ARICULTURE.

BY B. C. BASU, B. A., M. R. A. C., etc.

Of the nine provinces which go to make Belgium, East Flanders is the one most renowned for the excellence of its agriculture. The present memorandum embodies my own experience during my short stay among the Flemings, largely supplemented, however, by the reading of several important works on Belgain agriculture. I will confine myself to a delineation of the prominent traits of the proper Flemish agriculture, which has been, and still continues to be, the great wonder of all Europe. In conclusion, I will add a short sketch of the method by which the lowlands of Holland and north-western Belgium have been converted into fruitful plains. In describing any form of agriculture it has been always my plan to begin with the soil and climate of the country, which have mainly determined its nature. I will not, therefore, swerve from it on the present occasion.

Soil.—The influence of the constitution of the soil on its cultivation can be studied nowhere better than in Belgium. It superficial geology has been divided into eight regions, each of which is

defined by its flora and mode of cultivation. As we go from the sea to the interior, from west to east, we meet with formations more and more remote, while with these the level of the country gradually rises, till it attains its maximum in the Ardennes in the extreme west. The eight regions spoken of above are:—

(1). Region of the *polders* (East Flanders and Antwerp).

(2). Sandy region (including the *dunes*, the greatest part of the two Flanders, and the Campine).

(3). Loamy region.

(4). Clay region.

(5). Cretaceous region.

(6). Region of Condroz.

(7). Region of the Ardennes.

(8). Jurassic region of Luxemburg.

I need not severally dilate on these various regions; suffice it for my purpose to take the second one, that of sandy soils, in which East Flanders is included. This region displays again three minor subdivisions or zones, *viz.*, (1) the dunes, (2) the sandy part of the two Flanders, and (3) the Campine. The second of these is the one which we are specially interested in, as it is here that the skill and industry of man have attained a marvellous degree of perfection in the pursuit of agriculture.

It has struck me more than once that many people would call a soil rich when it yielded abundant crops. Such a predication suggests a total ignorance of the difference between the soil and its cultivation. The richness of a soil is the product of two, and only two, factors, its chemical composition and its physical characters. The richness of its cultivation is decided by the treatment, mechanical and chemical, which it receives. A soil may be rich, but yield little through bad treatment; on the other hand it may be poor, but very fruitful with judicious management.

Thus we hear very often people speaking of the "fat" fertile soils of Flanders. A glance at the country, however, will surely undeceive them of such delusion. In reality, Europe contains perhaps no poorer soils. They may be very productive, indeed they are, but their apparent fertility is all due to man. The soil of Flanders is composed of a poor extremely light siliceous earth, which, when dried under the sun, becomes literally reduced to "summer dust." The subsoil is ferruginous, and often forms a hard impermeable bed or pan, which the cultivator has to break and plough up by the spade and the axe.

The climate of Belgium differs very little from that of England, having about the same rainfall and temperatures as the eastern counties.

Flemish husbandry is distinguished by its extremely intensive character. Besides its great variety of cultivation and the importance it gives to catch-crops, it exhibits the use of the most active manures which experience, and, in latter days, science have placed at the disposal of the husbandman. In Flanders the most varied crops succeed each other in obedience to the laws of rotation. Among industrial plants we find rape, poppy for the oil, hop, flax, hemp, tobacco, chicory, and sugar-beet; as *alimentary* crops, wheat, barley, rye, buckwheat, beans, potatoes; as forage, various clovers, peas, spurry, vetch, cabbages, beet-root, turnips, swedes, and carrots. These give to the fields all over the year an air of fertility and life. The soil may be said to know no more repose than he who cultivates it. With crops so varied it is next to impossible to define the rotation which prevails in Flanders. It varies unceasingly even as the market, for indeed it is the latter that determines the choice of the cultivator. According to M. de Dentorghem, President of the *Comice Agricole de Saffleure*, the two rotations most in use are,—

Rotation A. (1) potatoes and beet root, grown together, (2) barley (and carrots), (3) flax (and carrots), (4) rye (and turnips), (5) oats (and young clover), (6) clover, (7) barley (and turnips), and (8) rye (and turnips).

On poorer soils. Rotation B. (1) potatoes, (2) barley (and turnips), (3) rye (and carrots), (4) oats, (5) flax (and young clover), (6) clover, and (7) barley or rye (and turnips).

The crops put between brackets are catch-crops. The great importance of catch-cropping in Flemish husbandry may be easily inferred from the above rotations; in A there is a catch-crop every year except for the first and the eighth, where the nature of the main crops (potatoes and clover) does not allow of a second crop being taken. Rotation B leaves three years only out of seven without catch-crops. The ceaseless succession of crops in Flemish rotations reminds us, indeed, of market gardening rather than of arrable farming. As regards the cultivation of ordinary crops, there is nothing very remarkable to note, unless the fact that the soil seems to be much better worked down, and surely better manured, in Flanders than perhaps anywhere else in Europe. Thus, for potatoes, the land would be dug up with the spade or the subsoil plough to a depth of 15 inches, nicely levelled, and then manured with about 30 tons of farmyard manure and 33 tons of liquid manure before it could be ready for the "seeds."

OUR AGRICULTURAL DEPARTMENTS.

In the popular mind the Agricultural Departments are usually identified with the introduction of new ploughs, big farms, European system of cultivation, and the like. No belief, however, can be more unfounded, neither can the popular mind be blamed for entertaining such a belief. People who are really interested in agriculture are quite ignorant of the language in which the manifold works of the departments are recorded. They can only take cognizance of what they see with their eyes or hear talked of around them.

Almost in every province the spectacle is presented to them of new ploughs and ploughing competitions and, seeing nothing else of importance, they naturally run away with the impression that ploughs are all that the Agricultural Departments have to show. In fact almost every Agricultural Department has to show a plough or two of its own. Madras has constructed new ploughs, the United Provinces have some, the Central Provinces have others, even Bengal which has come last in the race, has, during its short existence of barely one year, at least two new ploughs to show. All these ploughs may be very good in their own way but various circumstances stand in the way of their general adoption.

The almost universal adoption of the Beheea Sugar-cane Mill in Bengal within a very short time of its invention is a very good instance of the acute perception of the ryots in deciding the real value of new inventions and taking things for their real worth. That they have not taken kindly to any one of the newly invented ploughs is itself a convincing proof that they are not exactly the things which they want, if they want them at all. Similarly not understanding or being given to understand the object of the Departments in keeping Experimental Farms, using costly manures, European system of cultivation and the like, they form wrong ideas altogether of the working of the Departments. But these are the only things which they can see and the only works of the Departments which they can understand because they can see. Unfortunately, however, these are the very things which go against their grain and give them ample justification for condemning the Departments.

It must be distinctly borne in mind that these are only a few of the subsidiary points which has engaged the attention of the Departments. The various other important works which constitute the primary and initial functions of the Agricultural Departments and the carrying out of which has been seriously occupying their best attention, were they known as widely as the new ploughs and ploughing matches, big farms, and the like, would at once disarm hostile criticism from all sides. Let any one only glance at the annual reports of the Agricultural Departments of the United Provinces, Bombay, the Central Provinces, and Assam, which have only recently been published, in order to be convinced of their wide scope and that ploughs, farms, etc, are neither the only nor the more important part of their work.

In the United Provinces, for instance, the Agricultural Department was occupied during the year 1884-85 with a variety of works, among which deserved prominence was given to maintenance of village-records, analysis of districts with regard to protection from famines, and collection of agricultural statistics. In Bombay similarly, the range of subjects taken or proposed to be taken in hand by the Agricultural Department, from the organization and maintenance of village-records, analysis of districts with reference to security from famine, system of collection of revenue and rental in precarious tracts, measures of protection including arboriculture and irrigation to State and private experimental farms, a Central School of Agriculture and a Central Farm, of a consulting Agricultural Chemist to the Government of India, the creation of a University degree in Agriculture and Agricultural Science, experiments on various indigenous and exotic products such as wheat, tobacco, and cotton, crop-forecasts, agricultural and cattle shows, chemical manure, ensilage and fodder, improved agricultural implements, cattle-breeding and veterinary establishment, agricultural fiscal and trade statistics and compilation of rainfall returns in such a form as to show the effects of rain on different crops at different times and the rainy and rainless days of each fortnight—is very very wide. In fact the attention of the department was given to every event directly or indirectly connected with agriculture which occurred in the Presidency during the year.

In the Central Provinces again, the agricultural conditions of the year such as rainfall, character of the season, general health, progress of cultivation, area under different crops, experimental crop-cuttings with a view to determine more accurately the out-turn of the land, cattle disease, prices of staple articles, trade and condition of cultivating classes; and the reorganization of the staff employed for the maintenance and correction of the village maps and records chiefly occupied the attention of the Agricultural Department. The most interesting

and useful feature in the annual report of the Assam Agricultural Department is the addition of four neatly executed maps illustrating in colors for the Brahmaputra valley the percentages of (1) tea, (2) rice, and (3) mustard to the total cultivated area of each district, and (4) the percentage of cultivated to the total area of each distinct.

Is there any means, we ask, of apprising the peasantry, the class for whose benefit they are intended, of the whole array of useful work that is being done by the Agricultural Departments? Absolutely none!! The reports of their work are written in English of which the people are throughly ignorant and circulated amongst those whose interest in land is genrrally not of an abiding character. Early steps should be taken in each province to publish these reports or their abstracts in the vernacular or vernaculars of each province and circulate them widely amongst the people. To carry the people along with the Departments and to secure their sympathy and co-operation, both absolutely necessary to successfully carry out the programme of the Agricultural Departments, no better steps could be devised than the one we have ventured to suggest above. In conclusion we must add that in the United Provinces, the publication by the Agricultural Department of a *Urdu* Journal of Agriculture, containing extracts from the proceedings of the Department, from the Agricultural Journals of India, England, and America, results of experiments, descriptions of implement etc., is a move in the right direction.

RAB CULTIVATION OF RICE.

CONCLUSION

I have endeavoured to show the final results. I have asked that too close deductions be not attempted and I must not be the one to initiate such an attempt. But there are, first, a few explanatory remarks which I feel it expedient to make on the figures, before I give my opinion, as far as it is yet formed, on the whole subject.

The money value of rice in husk and that of straw are based on the price at which the rayat can dispose of the crop to the trader. He almost invariably sells immediately whatever portion is necessary to obtain the cash which he requires for the assessment on his land, and keeps the rest for his own consumption for barter for coarser food-grains and for grain-wages for labour required. I have made no deduction for loss by shrinkage, for the experimental weighments by me show that it is very insignificant. The reason is that the crop is cut dead ripe and left to dry in the field. The loss in weight after the threshing is very small.

On the other hand, the very necessities of experimental work, *viz.*, to secure equal conditions, precluded my taking into account the outturn of the headlands of the fields, where the yield is certainly less than in the middle portions. Therefore the figures for rice in husk and straw do not show the average outturn of the field, but a yield perhaps considerably above average. Again, in ordinary cultivation all the necessary operations cannot be performed with that exact punctuality which I made a point of securing, and which tends to show better results than the usual average. Therefore it must be borne in mind that, if anything, the value of the yield as well as the outturn is slightly above the average. On the other hand, I have no doubt that, with saving here and paring there, the actual cost of cultivation to the rayat is less than that shown by me from deductions from general data.

But some of the figures require explanation. In unrabed plots I have reduced the charge for home labour from Rs. 10 to 4, because the rayat would have to collect no materials for such plots.

In a concise form the results are as follows :—

		Per acre.	
Cowdung rab	Rs	32	profit.
Ain	„	$33\frac{1}{3}$	„
Fangal	„	$19\frac{3}{4}$	„
Leaf and grass in various combinations	„	9	„
Euphorbia	„	11	„
Kacha rab (sheep-folded)	„	29	loss
Unrabed plots, but manured ...	„	$7\frac{1}{2}$	profit.
Unrabed and unmanured ...	„	6	„

The result of the kacha rab is startling. The reason is that the rayat cannot get sheep to fold on his land without payment. But it must not be supposed that it is a loss to the rayat to fold sheep on his land. He actually does utilize this substitute for ordinary rab. No doubt at times he is able to secure sheep on more favourable terms than I did, but I am not certain of this. Another consideration must be brought to bear. The effects of the sheep manure last two or three years. This fact has been referred to before. It explains, as has been said, the equality of the results from the various kinds of rab (and especially of the kacha rab) at Igatpuri, where sheep-fertilized seed-beds were used.

The loss, therefore, in the year in which the heavy expenditure is incurred, is recouped by the extra

yield of the next two or three years. The proportion of seed-bed for this kind of rab is very high, but the yield is very good. I have no data yet to show the real measure of profit with this kind of rab.

It is customary for large proprietors to lease out rice land for a year's cultivation. In Karjat there are two recognized modes of sub-letting. Either the owner agrees with the cultivator to share grain and straw alike, or else (and this mode is the more usual) a fixed number of *mans* of paddy are agreed upon to be paid by the cultivator on the crop. In both cases the owner of the land pays the assessment. In both the cultivator provides the rab, and all labour for cultivation and harvesting. In the latter, however, the owner gets no share of the straw. The latter is called the *makta* or contract letting, the former the *ardheli* or half-produce letting. The *makta* rate varies with the character of the soil and with the condition of the land. So, where the embankments are out of repair, the owner receives a smaller share. It is his business to keep up the embankments. The *makta* rate is about 10 *mans* on the average per bigha (⅔ acre), but it would be at least 12 *mans* on land of the character of that of the experiment. This would mean 16 *mans*=1,184 lbs., worth, at the rates used in the tables herein contained, Rs 24. The profit, as shown by the experiment, comes to Rs. 54 per acre on the average for the customary varieties of rab at Karjat. This is the true rent of the land. The cultivator would thus secure nearly 1½ times as much as owner, but the latter would still be able to pay the Government assessment and leave a margin of profit. Taking the other case, the owner would receive 1,700 lbs. of paddy and 1 900 lbs. of straw, worth Rs. 42. But the crop was a very fine one and, as shown, over-represented by the figures herein contained. Naturally the *ardheli* letting would pay the owner best on good land.

I have still another figure to go on to illustrate the approximate correctness of my profit account. This land at Karjat is assessed at Rs. 4 per acre, but the yearly usufruct sells by auction at Rs. 14 per acre and the buyer always sublets the land to various cultivators. He can afford to pay this large charge, and yet profit by his speculation.

I must make a few remarks on the Alibag experiments. I have shown the figures as they have been received; but, as intimated, I was not able to direct the operations there, nor have I any means of checking the figures returned to me. I regret to have to say that this experiment cannot be accepted as elucidating in any degree the points which the experiments are designed to elucidate. The cost of cultivation has, I think, been enormously over-estimated. It is out of all proportion. I know well that the gentleman who conducted the experiments is a strong advocate of the necessity of rab, and yet the figures he gives, if true, would absolutely condemn rab. Rice-husk rab, according to his results, shows up better even than cowdung rab. The yield of the cowdung rab without accessories is even less than that of the unrabed and unmanured plot, or, as he rightly styles it, the plot of bare ground sown.

The following deductions may, I think, be drawn :—

(1) The manner in which the rayat utilizes the meterials he has at his disposal is the most economical and the most remunerative. Hence I judge that all attempts at teaching him to use manure, or leaves and grass, or the like, in a way different from that in which he uses them, are extremely hazardous, and require the utmost caution.

(2) Rice can be grown without rab. The ingenuity of the rayat has discovered substitutes. But I think it is proved that all substitutes are either more costly or more risky than the approved methods.

(3) Though rice can be grown without rab, yet rab greatly increases the yield, and therefore the food-supply of the country. The yield now suffices for the support of a largely increased population with, I believe, a considerable margin for export. If, however, diminished by prohibitions against, or scarcity of, rab it is a question whether this margin would not more than disappear.

(4) If the full value of the materials used for rab is charged in the cost of cultivation, rice cannot be grown with profit. Even without this charge the margin of profit in a good year, such as that during which the experiments were carried on, is not large. It has to cover the charges on account of true rent, from which must come the assessment both on rice land and whatever area is appended to rice land for the growth of rab material.

I trust that these deductions are sound. They are, at any rate, made from the unbiassed opinion formed after most careful study of the subject. But I am very far from thinking that I have mastered the subject. I have already begun arrangements for continued experiment. My conviction is that the only way to decide how far in the interests of forests, and in those of the people themselves more especially, the drain on the lands which produce the rab materials, whether in or out of

forest, can be prevented from causing exhaustion—a point which has nearly been reached in Igatpuri, Khadkala and Lanauli,—is to go on with the experiments now begun first to show precisely the position of the rayat and what it is tending to become, and thus to make it possible for Government to restrain him from improvidence where it is clear such restraint is necessary.

TABLE No. 1.

Appendix.

Yield per Acre of Rice in Husk per Acre of Rice calculated according to the Yield of the Seed-bed and outside Area.

Variety of Rab.	Khadkala.	Lanauli.	Igatpuri.	Karjat.	Average.
BURNT RAB.	Standard 100=2,822 lbs	Standard =1,554lbs	Standard =1,885lbs	Standard =3,796lbs	Standard =2,512
A.—Rab of accustomed varieties.					
1. Cowdung rab	100·0	100·0	100·0	100·0	100·0
2. Ain rab	89·3	100·8	...	94·9	95·0
3. Fangal rab	77·7	79·6	89·2	76·7	80·8
B.—Rab of uncustomary varieties.					
4. Leaf and grass	46·9	...	97·6	42·2	71·3
5. Leaf with pit manure	...	85·6	...	...	
6. Grass alone	...	84·3	...	...	
7. Euphorbia	...	...	...	39·3	39·3
UNBURNT RAB.					
C.—Quasi Rab, customary.					
8. Kacha rab (sheep-folded) ...	97·4	...	94·0	...	95·7
D.—Quasi Rab, not customary.					
9. Pit manure	...	47·2	...	...	56·7
10. Cowdung	66·3	...	...	...	
11. No rab and no manure ...	...	...	80·6	28·3	54·4

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THE INLAND TRADE OF CALCUTTA

[For 1884-85.]

The commodities the inland traffic in which is registered in Calcutta are cotton, indigo, jute, gunnybags, gunny cloth, wheat, gram and pulse, rice and paddy, other food grains besides wheat and rice, hides, salt, saltpetre, linseed, mustard, silk, sugar drained and undrained, Indian tea, and tobacco. The traffic enters or leaves the town by rail, by inland steamer, by country boats and by road, and the total quantity registered during the year under review consisted of 10,73,11,505, maunds, of which 8,36,91,573, maunds were imports and 2,36,19,932, maunds exports, the surplus of imports over exports amounting to a little over 6 crores maunds.

Compared with the previous year there was a decrease of 9·7 per cent in the quantity of the import trade and of 2·3 per cent in that of the export trade. The decrease observable in both was due to a falling off in the traffic by country-boats and roads, and, in the case of exports, also by the East Indian Railway, while there was an increase in the traffic by inland steamer and Eastern Bengal State Railway, and, in the

case of import, also by the East Indian Railway. If we take the commodities one after another, we see that as against 1883-84, there was a considerable decrease in the traffic of raw cotton, rice, wheat, linseed, sugar drained and undrained, and tobacco and only a slight decrease of cotton piece-goods and saltpetre, whereas there was an increase more or less in other items. Items the traffic in which suffered most were wheat, rice, and cotton, the three raw commodities which constitute the bulk of Calcutta inland trade. The partial failure of rice-harvest in Bengal, slackness of demand for wheat in England owing to good harvest there and large stocks available in America, and deficient out-turn and inferior quality of cotton crop in the Upper Provinces which are the main sources of cotton supply of Calcutta, had the effect of reducing the total traffic to the extent we have sketched above.

As the present depression from which trade is suffering universally has affected very much the jute trade of Bengal, it will not be out of place to begin a review of the entire inland trade of Calcutta with jute raw as well as manufactured.

The three Divisions of Bengal in which jute is largely grown and also to some extent manufactured are Dacca, Rajshahye and Bhagulpore. In Rajshahye, next to rice, jute is the most important crop and at Bhagulpore the ryots are reported to have brought an unprecedentedly large area of land under jute and mustard. During the year under review the crop was abundant almost every where, though the quality was not satisfactory.

The prices fetched for raw jute were however very low, falling, in Dacca for instance, from Rs 4-12 to Rs 2-8 a maund. The total quantity of raw jute imported into Calcutta was 1,30,53,436 maunds showing an advance of 23,94,011 maunds on the trade of 1883-84. The districts which supplied the greater part of the import were Pubna, Dacca, Furidpur, Rungpur, Mymensingh, 24-Pergunnahs, Nudeah, Rajshahye and Hugli, Pubna heading the list with 29,44,393 maunds. Pubna (Serajgunj) again heads the list of the principal river-marts whence large supplies of jute were carried by country boats. The steamer services of the Eastern Bengal State Railway carried jute largely, from Naraingunj in Dacca, Serajgunj in Pubna and Dacca town. Naraingunj and Serajgunj again were the two stations from which jute was forwarded in large quantities by inland steamers. The total traffic in raw jute during the year amounted to 2,34,18,635 maunds which showed an advance of nearly 42 lakhs maunds on the trade of 1882-83.

Besides being exported, jute is largely manufactured in India into gunny-bags and gunny-cloth. Of the former the principal seats of manufacture are in the districts of Pubna, 24-Pergunnahs, Hooghly, Jalpaigoori, Rungpore, and Dinagepore. The trade in gunny-bags showed a great development during the year, being an advance of 6,276,311 maunds on the trade of 1882-83. The districts which despatched gunnies in large quantities to Calcutta during the year were Pubna, 24-Pergunnahs, Hooghly, Julpaigoori, and Rungpore, Pubna as usual heading the list with 5,605,360 numbers manufactured with power-loom and 175 only with hand-loom. The two river-marts which exported the largest number of bags to Calcutta were Budge-Budge in 24-Pergunnahs, and Champdani in Hooghly. The export of gunny-bags from Calcutta during the year was the largest since the trade began, being in advance of 1883-84, also a year of large exports, by 30¾ per cent. The United Kingdom, the United States, Egypt, the Straits Settlements, and Australia made larger shipments than usual. Apparently the trade showed a great development, but virtually it was not so; the industry was carried on at a considerable loss to the manufacturers owing to over-production of, and low prices for, gunny-bags.

As regards gunny cloth, the total traffic including imports into and exports from Calcutta was confined to 35,120 pieces of which 8,690 pieces were machine-made and the rest hand-made, being an advance of 7,847 pieces on the trade of 1883-84. For the purpose of converting pieces into yards, a machine-made piece is taken as equal to 80 yards while a hand-made one equal to 22 yards. The districts from which the supply of gunny cloth came to Calcutta were Hooghly and 24-Pergunnahs. The large increase in the trade of gunny cloth was due to the same causes which operated in the case of gunny-bags, namely, low prices and over production.

Over and above the registered traffic of Calcutta, large quantities of machine-made gunny cloth were sent up-country direct from the mills in the neighbourhood of Calcutta without passing through the boundaries of the Port Commissioners.

There were during the year 19 jute-mills at work in the vicinity of Calcutta being one less than in the previous year. Of these 4 were in Hooghly 4 in Howrah and 11 in 24-Pergunnahs. The total number of looms and spindles in all these mills during the year was 6,406 and 122,142 respectively, working between them 38,50,260* maunds of jute. The manufacturers of Dundee who had formerly almost the sole monopoly of the jute indus-

* Represent the amount of jute worked up in 18 mills, the figures for the other mill are not available.

try of the world have been feeling keenly the great competition from Calcutta, which the competition of Continental mills has tended to aggravate.

From the statistics collected by a Dundee merchant, it appears that in the jute works in Germany there are at preseet 2,646 looms and 53,852 spindles and, although these figures may seem miserable by the side of the Indian spindles, to say nothing of the Scotch, they show the vigor with which the youngest of the textile manufactures has been pursued by the Germans. So far as we know, India is the only country which produces raw jute and if we can but keep pace with the growing industry, we need not be afraid of Dundee, far less of Germany.

HILL-IRRIGATION.

Our readers may remember that in Britanny in France, where the land, excepting in the immediate border of the sea, is hilly, the system of hill-irrigation consists in tapping springs on the top or side of a hill and in damming up the spring-water in a reservoir or a series of reservoirs as the case may require, whence the water is distributed by means of primary and secondary RIGOLES (Canals) to the land lying below.*

By way of contrast a short description of the system of hill-irrigation pursued in the Sonthal Pergunnahs will be read with interest. A correspondent of ours who had been over a part of the country sent us a short note on the subject, the purport of which we reproduce below.

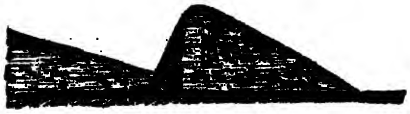
The part of the Sonthal Pergunnahs which he visited was the country lying to the right side of the East Indian Railway line between the Stations of Kharmathar and Madhupur. The country presents an undulating surface scantily clothed with vegetation. *Mahua* (Basia latifolia) and *Sal* (Shorea robusta) are the only two trees of economical value to be seen clothing either the hills or valleys. From the flowers of the former is distilled a spirit and their seeds a kind of oil is expressed which goes by the local name of *Konchra.* The area of cultivated land is very small and principally confined to the neighbourhood of villages which are few and far between.

The valleys where deep are usually intersected by small river streams which in summer dry up either entirely or leave only a thread of meandering water of microscopic proportion. These river-streams are called locally *jorh.* Land from the hills to the valleys descends either in gentle slopes or precipitously. During the rainy season, the rain-water flows down the side of the hills and collects on the *jorhs* where it helps to form torrents. Immediately after a heavy shower of rain, these fords or *jorhs,* as they are called, are scarcely fordable; but in a few hours' time the water passes away in a torrent leaving the bed of the streams almost dry.

To arrest the downward course of the rain water and utilize it for agricultural purposes, the cultivators have devised two very ingenious though very simple methods of storing up and utilizing the rain water. Where the slope from the hills to the valleys is precipitous, and the area comparatively small, the cultivators cut up the lands into a series of steps or terraces, each step or terrace being surrounded on three sides by high ridges. The rain water in its descent from the top of the slopes to their bottom is arrested in each of the terraces in the order of their descent, and not allowed to fall into the streams and be discharged until the want of the terraces has been satisfied. The water which, were it not for this device, would have come straight down the slope and been lost, is thus stored up, however temporarily, by this system of cutting up the land into terraces and confining each within high; ridges and becomes the means of bringing under plough an area otherwise perfectly waste. The lands which are thus brought under cultivation are called locally *Kanali* or ridged.

There is another system however of storing rain water, equally simple though not equally inexpensive. Where the slope of the land is comparatively gentle and the area large, artificial dams or bars are thrown across the land at right angles to the direction of the slope. In the rainy season rain water collects behind these dams and forms a kind of pond or lake varying in extent with the area from which the drainage collects and the length and height of the dams. To prevent the dams giring way with the rush of water during years of heavy rainfall, exists are left in suitable places for the surplus water toe scape. The pools or lakes in which the drainage water thus collects are called locally *bandhs.* The big *bandhs* cold such a large quantity of water that even in years of drought they do not dry up and become the means of saving the lives of thousands of human beings as well as lower animals, especially village cattle. When water is wanted for cultivation, the dams or embankments are breached and water let out for irrigating the lands lying below the *bandhs.*

* See Ind. Agr. Gazette, No. 8 pp. 177-178.



The accompanying diagram is meant to convey a fair idea of a hill *bandh*, so very common in the Sonthal Pergunnahs. In India where agriculture is mainly dependent on the amount and distribution of rainfall, it is noteworthy to observe that when within the means of the cultivators, they have spared no pains nor grudged any labour to utilize any mean of water supply.

THE DUTIES OF AN AGRICULTURAL DEPARTMENT.

III.

(Agricultural Education.)

It is one of the gratifying signs of the times that an influential portion of the Native Press has newly awakened to the question of technical education, particularly of that branch of technical education which has reference to agriculture. We have repeatedly adverted in the columns of this Gazette to the great need for agricultural education in this country. Whether for disseminating the results of scientific researches among the peasantry, or for stimulating the lethargy of the people into activity, agricultural education is, in our opinion, an indispensable necessity. Those who have carefully studied the march of agriculture and other industries in Europe have long expressed their convictions in a loud and emphatic way that can never be misunderstood.

From the Report of the Royal Commissioners on Technical education, it appears that while the latter has all along been an object of tender care on the part of Continental States, it has as yet received but very little support and encouragement of the kind in England. The consequence has been anything but desirable. From the neglect which technical education has so long suffered, England is gradually losing the high esteem of her neighbours who are now fast outbidding her in the market.

Now if we turn to the particular subject of agricultural education, we shall see that it has shared the same lamentable fate as its sister industries in England. Mr. Jenkins, who had been deputed by the Royal Commissioners to enquire into the teaching of agriculture in the United Kingdom, and in France, Germany, Belgium, Holland and Denmark expressed his sincere doubt whether much of the distress prevailing among the agricultural classes of the kingdom could not be alleviated, if not averted, if earlier and more comprehensive measures had been taken to diffuse agricultural education among the landed interest. In all the Continental countries which came within Mr Jenkins' enquiry, the need for agricultural education has long been understood, and the States have not been behind to meet its growing want. France and Germany, Holland and Belgium have each a Minister of Agriculture, disposing of a large amount of public revenue in measures calculated to contribute to its well-being and prosperity. Of such measures, agricultural education is always a prominent one; and we have only to glance at Mr Jenkins' Report to see what extraordinary expenditures the State often goes into for its sake. Whereas, on the other hand, agriculture has never been a favorite with British legislators and statesmen who seldom gave the consideration it deserved. The result has not been satisfactory in any way. Agricultural education is sadly wanting among the rural population in spite of the strenuous endeavours of philanthropic agriculturists and patriotic societies. English farmers are notable specialists it is true; but their special excellence seems to have been more or less of an empirical nature, having been inherited, in the manner of all traditional skill, from generation to generation; and granting that they excell in special branches of agriculture, they do not yet possess that theoretical knowledge which enables many foreign agriculturists in an emergency to adapt their cultivation to altered circumstances. It seems now to be a pretty well established fact that the time has long gone by when the State could safely leave the interests of agriculture in the almost sole keeping of private agencies, but that it should come in now with all the aid it can afford to mitigate the evil fruits of its past neglect. Of the various measures which have been advocated to this end, agricultural education has been urged very strongly on the notice of the British Government. Thus even in England where the State had so long stood aloof from all intervention, and where powerful patriotic societies and associations had sprung up as sole outgrowths of individual and corporate enterprize, the faith in the *laisez-faire* policy has now been rudely shaken. The spirit of the age has been reflected upon the Government; and agriculture, along with its sister industries, is likely to receive increasing consideration at the hands of the Legislature. Thus we see that even in European

countries where agriculture holds quite a minor place among national industries, deserved attention is being given to the questson of agricultural education. Why should it be otherwise in India, where agriculture preponderates over all other interests ?

But without drawing support from the examples of foriegn countries, the great need for all technical education indeed, may be deduced from *à priori* considerations. Half a century ago, things were very different from what they are at the present time. Science has brought about a far reaching revolution in arts and manufactures, to which almost all handicrafts have fallen a ready prey. Before modern looms and steam mills had been introduced in Lancashire, Indian cotton goods could hold their ground against the whole world. But the order of things has since undergone a total change. All the beautiful handiworks for which India was once so celebrated among the nations of the world have been declining, and are not unlikely to soon disappear. In the keen competition which singularly characterizes our age, it is always the strongest that shall survive ; and if any one fails to make good his own claims before his neighbours, it is ordained that he shall perish. Turning to Europe, we see that that the skill and intelligence of every European nation is screwed to the highest pitch to discover new ways and methods of industry, wherewith it can forestall its rivals in the international market. N w we think it is admitted on all hands that the skill and intelligence of a people are most developed where the minds of the young generation have been trained in the respective industries which are to be its future prospects. This is saying nothing more or nothing less than that technical education in early life is a royal road to future industrial success.

It is but due to us to say that our English rulers have long since been alive to the subject of agricultural progress and famine relief in India ; to these ends, railways and irrigation canals have been constructed at immense expenditures. These are all important, we have no doubt ; but we venture to think that for the full realization of agricultural progress, agricultural education is one of the first measures which the State should take into its consideration. For it is plain that if the salvation of the ryot is aimed at, it can only come from the ryot himself ; for, if the Government goes beyond simply putting the ryot on the right track, and tries to keep him in leading strings, it would be altogether following the wrong scent. Education alone can give the ryot that catholicity of mind which he so badly wants ; it will also enable him to shake off the narrow conventionalities of his age and country, and to adapt his operations to the changes of time. Agricultural education will give him, besides, some insight into the workings of Nature, which, though it may not give him an immediate command over her, will do this much at any rate that he will have a more intelligent understanding of his own work.

Before speaking of the means which ought to be adopted, in our opinion, to give effect to the proposal of agricultural education, we take this occasion to say a few words on a point connected intimately with the subject of agricultural improvements. It is well-known that the economical state of the country would never have been so deplorable, had things been going on as they did in days of yore when India had very little of Foreign Trade worth the name. For better, or for worse, the order of things has since been totally reversed. Barely half a century has elapsed since the handicrafts of India used to be in their full swing, and millions of hands were kept engaged to provide for the immense consumption of her dense populations. But it is far from being so now. Before western manufactures, almost all our handicrafts have gone one after another to the wall, and Free Trade has done what still remained to consummate their ruin. The evil consequences which followed in the wake of our industrial decay are too manifest to be spoken of here at great length. Millions of destitute artizans have been thrown back upon land as their last resource ; and people have been trying since to elbow out each other from the field for mere subsistence's sake. Such a sad reality could not possibly escape the notice of the Famine Commissioners ; let us now turn to the pages of their Report to see what remedial measures they recommend to mitigate the sufferings of our industrial classes. In page 176 of the Report, we read :—

"All the causes which render such action (encouragement of technincal education) on the part of Governments desirable in Europe apply with greater force to India. Experience, however, is still wanting even in England, as to how such instruction should be given, and for India it will be hardly possible at present to go beyond the training of ordinary workmen in the practice of of mechanical or engineering manipulation.

"To whatever extent it is possible, however, the Government should give assistance to the development of industry, in a legitimate manner, and without interfering with the free action of the general trading community, it being recognised that

every new opening thus created attracts labour which would otherwise be employed to comparatively little purpose on the land, and thus sets up a new bulwark against the total prostration of the labour market, which in the present condition of the population follows on every severe drought."

The passage quoted above explains itself; let us only add that for the salvation of the ryot, agricultural education alone is not sufficient; but that so long as land be not relieved of its superabundant population, much improvement in the condition of the ryot and indeed of agriculture in general can not be looked for.

[To be continued.]

NEWS.

United Provinces.

The 3rd or January forecast of the wheat and oilseed crops of the United Provinces.—Like its predecessors it deals only with the condition of the crops. The area will be reported in April when complete and accurate statistics will be available. The materials for the present forecast were obtained, as before, from returns sent in by the reporting zamindars. 312 returns of the condition of the wheat crop and 306 returns of the oilseed crop have been received. The January condition and prospects as stated by the zamindar reporters are as follows:—In the Meerut, Rohilkhand and Agra Divisions there was rain amounting to about one inch. Good but partial showers also fell in the Lucknow, Faizabad and Sitapur Divisions. Irrigation has been much less resorted to than usual and much labour, and expenditure have thus been saved. Hail is reported from different parts, but has done no injury. Rust showed itself in the wheat here and there in consequence of the cloudy weather and damp easterly winds—but it was slight, the crop was too young to suffer much from it, and the rain that followed washed it away. The rapeseed was here and there threatened with a fungoid disease called variously "lassi" and "mahu"—but appears to have escaped without much damage. If February, March and the early part of April are favourable, there seems every prospect of a most plentiful harvest all over the provinces.

Central Provinces

The fourth report on the prospects of the Wheat Crop is as follows —Prospects remain practically the same as last month; the hail which fell in the first week of March having done but little damage in Seoni, Balaghat and Raipur. Prices, however, generally rule lower than at the date of last report. Exports continue to decline and are less by 450,000 maunds than they were last year.

Punjab.

The reports on the prospects of the Wheat Crop for the month of March 1886 is as follows.—Wheat prospects decidedly improved. Late sowings were made after rain in December and January. and the estimated area now is 6,700,000 acres. Rain this month has also been most beneficial.

Bombay.

The report on the prospects of the Wheat Crop for the month of March 1886 is as follows.—Sind.—In spite of some injury from insects in parts of Hyderabad and from frost in parts of Thar and Parkar, the crop is on the whole flourishing, especially in Shikarpur, the chief wheat-growing district. *Gujrat.*—Smut lingers in parts of Ahmedabad, but the Gujrat crop is on the whole good. The crop is 11 annas on an average in Ahmedabad, 6 to 12 annas in Broach, 7 annas in the chief wheat taluka of Surat, and 8 or 9 annas in the chief wheat taluka of Karia; in the Panch Mahals the area is very small and the crop very poor. *Baroda.*—Area estimated at 110,000 acres, that is, about 17,000 acres less than last year; crop fair. No change in other States, Deccan.—Rust continues more or less in all districts especially in irrigated lands; except in part of Nasik the injury from rust seems slight, and the crop will be a full average one. Khandesh crop 11 annas, Nasik 9 annas, Sholapur 11 annas, Satara 12 annas, Information for Poona and Ahmednagar not complete. *Karnatic.*—Rust prevails here and there, especially in Dharwar, but the damage is slight. Crop 11 annas in Belgaum, 9½ annas in Bijapur, and 8 annas in Dharwar. In the Southern Maratha States crop above average, though a certain amount of rust is visible everywhere.

The report of the Cotton Crop for the month of March 1886 is as follows:—Forecast deals with outturn. *Sind.*—Hyderabad estimate reduced from 12 to 10 annas; greater injury from boll worm than was expected; total for the province about 9 annas. *Gujrat.*—Prospects in North Gujrat considerably deteriorated on account of frost and want of moisture, but very good in Broach; revised estimates:—Broach 12 annas, Ahmedabad 9 annas, and Surat 8 annas. *Baroda.*—figures received; area 418,000 acres, or 70,000 acres more than last year; crop 12 annas. *Kathiawad:*—Sorath 9 annas, Jhalawad (north) 11 annas, Halar 13 annas, and Gohilwar 14 annas. *Cutch* 10 annas, Palnapur and Mahikanta 8 annas. *Deccan* —Khandesh crop 11 annas; exotic cotton reported to be equal in extent to indigenous, but this is probably incorrect; the exotic cotton better than indigenous; remainder of Deccan crop 4 annas. *Karnatic.*—indigenous 10 annas, exotic cotton 8 annas in Dharwar; proportion 3 to 2; crop 8 annas in Bijapur and 9 annas in Belgaum. In Kolhapur and Native States, crop stunted and much below average.

Berar

The report on the prospects of the Wheat Crop for the month of March 1886 is as follows:—Wheat crop in good condition and nearly reaped.

Area under crop quite up to the average, being 808,514 acres. Yield generally from 12 to 14 annas. The total outturn is estimated at 120,000 tons.

United Kingdom.

Russia and Australia having a much smaller surplus than usual to come during spring and summer, seem likely to afford chances to English, American, and Indian wheat samples. Moreover this season, so far, the competition of foreign flour is much less keen than it has been on former occasions. Prices in other wheat importing countries :— Holland, Belgium, Switzerland, parts of Germany, and Spain, are rather above those current in the United Kingdom. Indian wheat quoted in the Mark Lane Express for the week ending 15th February was from 28s. 6d. to 32s. 3d. In America the visible stock of wheat is now only about half a million qrs. more than the quantity held in 1885, whereas at one time it was three million qrs. in excess.

Germany.

The price of wheat as elsewhere has been more depressed during the past year than in 1884, the average being as low as 32s. 1d. a quarter, whereas it was 35s. 5d. in 1884—equal to a fall of 2s. 7d. a quarter. We must look back more than a century to find its parallel. In 1748-9 the yearly average was the same as in 1885 ; true, in that interval the averages had been lower, for in 1750 it was 28s. 10d., again in 1754-5 it was 30s. 9d. and 30s. 1d. respectively, and in 1761 it stood at 26s. 9d. With these four exceptions wheat has not been so low for 136 years. The highest point reached in the past year was 38s. 1d. on the 9th of May, and the lowest 30s. 2d. the last Saturday in 1885. The fluctuations have, therefore, only been 7s. 11d ; in 1884, it was 8s. 7d. ; in 1883, 4s. 10d. ; and in 1882, 12s. 1d. a quarter.

The Revenue Industrielle states that a German manufactory is turning out over a ton a day of glucose made from old linen rags. *The American Bee Journal* says these rags, which are composed of hard vegetable fibres, are treated with sulphuric acid, which converts them into dextrine. The latter product thus obtained undergoes a washing with milk of lime, and is then treated with a fresh supply of acid stronger than the former, when the mass is at once transformed, and crystallises into glucose, of which confections, honey, and jelly may be made. The process is said to be a very cheap one, and the glucose chemically identical with grape sugar.

France.

In France the Tariff Commission has been hearing the representatives of the distilling trades, who are strongly opposed to a duty on maize as favouring the importation of alcohol already distilled, and therefore injurious to native industry. The Commission on Sugars had an audience with the Finance Minister, who proposes (1) to suspend for two years the duty of 7 francs on European sugars, (2) to place a surtax of 3 francs on sugars from foreign colonies, (3) to put French colonial sugar on the same footing is that produced in France. Six new professorships of agriculture are about to be founded, namely, for Morbihan, the Oise, the Marne, Cantal, Ardeche, and Haute-Saone. The Society for the Encouragement of Agriculture in the Seine-et-Oise has voted £80 for the creation of experimental fields in each arrondisement and £40 towards the formation of local agricultural co-operative syndicates.

The importation of wheat into France between the 1st of August, 1885, and the 31st of January, 1886, was 2,344,620 metric quintals, and that of flour 84,270 quintals. During the correspoding period of the previous year the importation was 6.844,809 metric quintals of wheat and 303,664 quintals of flour. The exportations within the same term were 7,688 quintals of corn, and 39,189 of flour, against 21,715 of corn, and 44,632 of flour during the anterior period. There has consequently been a diminution of 4,517,216 metric quintals of corn and 231,366 of flour representing a value of 100,000,000 francs. This result is attributed by Free Traders to the establishment of the import duties of three francs per 100 kilos on corn, and of seven francs on flour. These duties were, of course, to raise the home quotations, but the fact is that corn is this month quoted in Paris at 21 francs to 21 francs 75 centimes the 100 kilos., whereas in February last year its price was 21 francs to 22 francs 50 centimes.

Australia.

The *Australasian* of Dec. 26 says:—We publish this week our estimate of the wheat crop. From the reports of our agricultural reporter, who in Australia has completed his annual tour of inspection through the principal wheat-producing districts, and the "Harvest Returns" sent in by our numerous country correspondents, readers of this journal have been prepared to hear of a total result not only less satisfactory than was expected a few weeks ago, but considerably lower than last year. In the portion of the northern areas lying between the Loddon and the Wimmera, the crops are the poorest on record, and the production of wheat is less upon that section by 2,750,000 bushels as compared with last season. Upon the country east of the Loddon the crops are better than last year, which, to some extent, makes up the deficiency. There is, however, an estimated deficiency, as compared with last year's yield, of 1,426,000 bushels, the total being 10,015,000 bushels, as against 11,441,000 bushels last year. Had the average been calculated upon the whole area of wheat sown, it would not have reached quite 8½ bushels, but a deduction of more than 100,000 acres had been made to allow for wheat cut for hay and not harvested at all, owing to failure. Upon the area of 1,058,200 acres estimated to be harvested for wheat, the average is expected to be 9·46 bushels, or nearly 9½ bushels per acre. In comparing the results with those of last year, the estimate of the *Australasian* has been employed, as the business of the year has proved it to be more correct than the Government agricultural statistics,

which last season returned the wheat crop as only 10,433,146 bushels. After making the usual allowances for home requirements this season, our figures only show a surplus of 3,077,500 bushels or about 82,433 tons of the new crop available for export. In South Australia the heat has been intense, and the wheat crops continue to turn in the unsatisfactory manner already reported, the maximum average now estimated being about 8 bushels per acre. A correspondent of the *Gipps Land Mercury* says that the average under crops in the colony is much less than it was last year, having been reduced from about 1,800 acres to not more than 800 acres.

Central Provinces.

The quantity of wheat exported from the Central Provinces to the port of Bombay from the 1st of October last up to the 13th of Marth was 9,22,411 bags, (2½ maunds each.) as compared with 1,323,543 bags exported during the corresponding period of last year.

China and Japan.

The quantity of tea exported from China and Japan to Great Britain from the commencement of the season to the 2nd of March was 146,969,922 lbs. The exports to the United States and Canada during the same period were 79,989,291 lbs., as against 70, 803,866 lbs.

London.

An Indigo Company Limited, with a capital of £ 150,000, has just been started in London for the purpose of purchasing the patents for British India for an improved process of manufacturing indigo; of working the same in factories to be purchased or leased by the Company in India; and of granting licenses to indigo manufacturers to use the process on payment of a royalty. Sir Frederick Haines, formerly Commander-in-Chief in India, is one of the Trustees.

EXTRACT.

Experiments in Wheat Hybridization.

In the *Country Magazine* Mr. Charles Barnard writes.—Compared with wheat, rye is a modern plant. It is not figured on any Egyptian monuments, and seems to have been first cultivated in the Roman Empire about the beginning of the Christian era, though it may have been known somewhat earlier in Russia and Tartary. While these two commercial plants have been cultivated side by side for centuries, the first plants appearing to be true hybrids between them bore seeds this year in this country. Wheat and rye may have been crossed before, yet there appears to be no record of anything like the results here obtained. Having made a personal examination of the crossing of these two plant races, the writer may be prepared to report the history and present aspect of this most interesting experiment.

Wheat is self-fertilising, the pistillate and staminate portions of the flower being close together and enclosed in a casing completely protecting them from contact with pollen from any other flowers. The flower is practically shut out from all natural crossing, and the only way in which a cross can be obtained is to open the case protecting the flower and make a purely artificial crossing. In this way all the crossed varieties of wheat have been produced. The first step in the experiment was to make an artificial crossing between wheat and rye. For the female plant a head of Armstrong's beardless white was selected, and the flowers were carefully opened and the stamens cut out with a pair of scissors while still green. Shortly after, when the pistils were in the best condition pollen from a head of common rye was dusted over them and the casing carefully closed again upon the wheat pistils, and fastened by means of a paper ring. This was repeated three times on each of the flowers where the stamens had been removed. This was in the summer of 1883, and from one head of wheat ten good seeds were obtained. These were planted on the 29th of the following September, and in due time nine new plants appeared, grew, and lived through the winter of 1883-84. In the summer of 1884 eight of these plants produced good seeds, and one plant produced a few apparently sterile and worthless seeds. The experiment here divides into two sections. The good seeds from the eight plants were planted in September, 1884, and produced many strong and healthy plants that survived the winter and bore this summer the greatest variety of wheat, some beardless, some fully bearded, some of one type and some of another, but all more closely allied to wheat than to rye.

The result of this experiment is interesting, and it will in the future be continued, the various kinds being divided and again cultivated to see if the new types will be permanent. This portion of the experiment need no further discussion, as the other branch, with the plants springing from the apparently sterile or worthless seeds, is of more interest. One of the original nine plants produced 13 heads, giving 17 shrivelled and narrow

grains. The plant exhibited some of the features of rye, and this led to the hope that the seeds might germinate. The 17 seeds were planted September 29, 1884, and 15 plants grew up and safely passed the winter, two of the plants having been accidentally destroyed. These 15 plants in July, 1885, presented a most curious appearance and bore heads of wheat closely resembling rye. The average height of all the plants was 3 feet 5 inches, the tallest plant being 4 feet high. The best plant had 13 heads, the poorest only two heads. There were 107 heads in all or an average of 7·1 heads to a plant.

All the heads produced more or less seeds and 15 seeds selected, one from each plant, appeared to be in every respect good and perfect seed. Of these, five were larger than the largest wheat, and these were larger than rye and closely resembled rye in shape. As a whole the seeds appeared to be wheat, and yet had somewhat the shape of rye. No experiments were made to test the flouring qualities or taste of these seeds. That must come later when more seeds can be obtained. The point of interest lies in the fact that good seeds that resemble wheat were obtained from plants that had all the distinctive features of rye plants. An examination of these 15 plants showed the following points :—

1st, size and strength of stem and glaucous (or blue) colour; 2nd, tomentose appearance of stem, or fuzziness of stem just below the heads; 3rd, the heads were larger and narrower than wheat, and had more spikelets, being an average of 26 spikelets to each head; 4th, the glumes were marked more like rye than wheat, and the heads were bearded more like rye than wheat. In one head there were 67 glumes, 34 on one side and 33 on the other. These features of colour, bloom, shape, and character of heads seem to indicate that the plants followed their rye or male parent. They were considered by experts to be rye plants. The seed, on the other hand, is more like wheat than rye, and plainly not rye.

The object of this experiment is to see if a hybrid plant can be produced that will give seeds as good as wheat and yet be as a plant like rye; that is, a plant that will grow where wheat will not, or in fields exhausted by wheat, and will be as hardy as rye and ripen its seeds earlier than wheat. The fact that the young plants survived one winter is something, and the seeds certainly ripened earlier by several days than the original Armstrong wheat. At the present stage of the experiment, plants giving good seeds and having all the features of rye have been obtained. In other words, wheat has been produced from plants plainly not wheat. Whether the future plants will retain this combination of plant and seed characteristics remains to be seen. The experiments have been conducted with the greatest care, and the result, even at this point, is both interesting and of the greatest promise. Should the future plants give good flouring wheat and have the good qualities of the rye plant, it may prove of the greatest benefit to the leading cereal crops of the world.—*The Mark Lane Express.*

Resources of Upper Burma. *

Note by Dr. Romanis, Chemical Examiner, on his return from the Upper Burma Expedition.—*Agriculture.*—There is little cultivation from Thayetmyo to Nyaungu, near Pagan, except near Sinbyugyum at the mouth of the Salen river; and the country is dry and barren. From Pagan to Ava the west bank, including the delta and valley of the Chindwin, is fertile. Myingyan, which may be considered the commercial capital of Upper Burma, is the centre of this district. The staples are maize, millet, sesamum, pulse, and cotton, the latter exported to China.

The east bank round about Mandalay and towards the south-east along the valley—the Myituge—is a rice-growing district, about 30 miles in length by 15 in breadth.

Between Myadaung and Bamaw, both on the Irrawady and north of Mandalay, is a sparsely inhabited district which seems fertile, but is reported to be very unhealthy.

Minerals.—Coal occurs at three localities on the west bank near Thingadaw and at Kabaing nearly opposite on the east bank, and is reported to be found near Sagaing opposite Ava. Good coal is reported to occur at Kale on the Chindwin far to the north-west. The Thingadaw coal was worked by the Burmese for some time.

*From Rangoon, the capital town of Lower Burma, to Mandalay the seat of Government of the late king of Upper Burma, the river Irrawady stretches almost due north. Thayetmyo lies at a distance of nearly 200 miles; north of Thayetmyo is the town of Pagan. Ava lies to the north-east of the latter place at a distance of nearly 100 miles in direct line. Half way between Ava and Pagan is the town of Myingyan, the commercial capital of Upper Burma. From Ava to Mandalay the distance is about 20 miles. All these towns are situated on the east bank of the Irrawady.

Petroleum.—The best known locality is Yenangyaung about 70 miles south of Pagan on the Irrawaddy. The oil here is very viscid, flowing slowly into the wells. It contains much paraffin. At Pagan on the west bank of the river, and a short distance from it, there was a well flowing some time ago rather more limpid, also containing paraffin. There is said to be petroleum in the Yaw country west of the Tangyi hills opposite Pagan; it is described as flowing from springs at the surface of the ground. It is said to be more limpid than the Yenangyaung oil, resembling the Boronga oil. It is only used locally as there are no roads in that district.

The yield from Yenangyaung is estimated at 600,000 viss, or 1,000 tons per mensem.

There are two groups of wells there, about three miles from the river, with about 200 wells producing oil, many others exhausted. The oil occurs in little basins like the Baku oil and unlike the American, which seems to form subterranean lakes.

Iron.—Iron was once worked at Pupadaung, 30 miles from Pagan. The manufacture is now discontinued.

Silver.—Silver and lead are brought from the Shan States lying to the east of Upper Burma. The great silver mine at Bawdwingyi is now flooded and not worked.

Gold.—Gold is said to occur at Bamaw, but, it is believed it comes really from Yunan lying to the further north of Shan States.

Platinum.—Platinum is said to occur in the sand of the Chindwin near Kanni. A large quantity of what was supposed to be platinum ore has lately been collected and sent to England from this locality. I hope to have an opportunity of examining this district in the hot weather holidays.

Rubies.—The Burmese are very proud of their ruby mines: "Lord of the Ruby Mines" is one of the official titles of the King of Ava. The rubies, or more probably spinels, are found in the crystalline limestone of Sagaing, 16 miles north of Mandalay, and at Mogauk and Kyatpin near the Shwen mountain. They were described as occurring in three ways; 1st, in quartz rock? (limestone); 2nd, in the soil on the mountain side; 3rd and chiefly, in a bed of gravel below the surface called hma-sa. This gravel is full of water and the rubies are obtained by sinking a well till this stratum is reached. Then a man descends and going beneath the water fills a bucket and sends it up. At the surface the rubies are separated by washing from clay and sand. The large ones are carefully picked out and the remainder crushed to powder and used for polishing. It is composed mainly of octahedral crystals of spinel. It is extremely improbable that alumina should crystallize in quartz. What they call quartz is probably crystalline limestone as at Madaya, or some other metamorphic rock.

The present holder of the mines had contracted to pay 2½ lakhs of rupees to the King, but he is unable to do it.

Jade.—This stone is much valued by the Chinese. They obtain it in the river-bed at Mogaung in water-worn boulders. These find their way to China *via* Rangoon, the waterway down the Irrawaddy being easier than the caravan route over the mountains between Bamaw and China.

Marble.—Marble is quarried at Sagyin, 16 miles north of Mandalay.

Geology.—The general geological structure of the country is very simple, the principal formations run north and south in great mountain ranges.

The tertiary formations of Pegu extend to Kyontalaung in the great bend of the river below Ava.

The metamorphic rocks of the Martaban hills are continued in the Shan hills east of Mandalay. The limestone of the Salween in the 2nd defile in Kachin hills east of Bamaw represent the Dawna range east of Moulmein.

The country west of Irrawaddy is almost unknown. As far as Pagan it is obviously the same formation as the east bank. Then we have alluvial plains between the Chindwin and Irrawaddy.

The Irrawaddy valley between Sagaing and Male at the head of the defile has been described by the late Dr. Oldham. The hills to the westward are alternately metamorphic and tertiary rocks. The same condition exists along the west bank as far as Thigyaing, where the river turns to the eastward.

The country generally has a great resemblance to the North-West Provinces and bears the same relation to Pegu which they do to Bengal.

Fuel and Fodder.

The question of fuel and fodder preserves is one very material to the well-being of the people in all those parts of India which are liable to drought. The effect of our system of settlement of the revenue demands, for long periods upon light terms, has been to cause pasture to be broken up to an extent which, in many parts of the country, has thrown the people back almost entirely upon stall feeding for their cattle. Indeed, the custom is becoming more and more prevalent for them to sell off their plough cattle when ploughing

is over, and buy again on the recurrence of the season for agricultural operations. In many districts of Upper India, the increasing incidence of the population upon the soil has had as much to say to breaking up of village commons as the limitation of the revenue demand. Whatever the cause, the result is everywhere the same: the grazing grounds are disappearing; the people grow fodder crops, and trust to their stacks of *juar* stalks and of chaff for the feed of their cattle.

One day there comes a drought; then there are no fodder crops and the cattle come upon the stacks. But these have deteriorated: the contents of even a third year stack afford very little nourishment, and the older stacks are practically worthless. Then the people dig up the roots of the *dub* grass, they chop up the *sar* of the *sarkanda* grass, they lop the trees—and when all these resources are exhausted, they drive away such cattle as have strength to move, to other parts of the country where pasture is to be found. This latter is, however, a very troublesome and a very costly measure. Change of air and diet does not suit the cattle, and numbers never live to return to their familiar stalls. Thus, before a zemindar will send his beasts away, he will exhaust cash and credit to buy the wherewithal to feed them at home. The old and weakly he sells *sub rosa* to the butcher, or leaves to starve and die; and he devotes his whole resources to the good milch kine and the plough bullocks. When the crisis is over, we find him desperately impoverished, both by the cattle he has lost, and by the sacrifices incurred to keep alive those which remain.

To meet this periodically recurring calamity, the Government has, for some years past, been considering ways and means of creating fuel and fodder preserves, which shall be available in times of drought to the people in their neighbourhood. At first sight this would appear to be chimerical, because a drought affecting the fodder crops and the pastures of the people must equally affect the Government reserves in the same tract. But this is while the word fuel is applied to the proposed preserves. It is supposed that drought will less affect the grass in well wooded preserves than the bare sun-scorched plains around. Moreover, trees themselves afford fodder, as is evidenced by the lopped appearance of all those trees which are scattered about the fields and homesteads of the drought-smitten tracts. In 1877-78 the very palm trees of the Multan division presented a remarkable appearence. Their fronds wherever within reach of the starving cattle, were chewed into mere fibre, and the wood stretching forth skeleton hands from the trees like mute, appealing witnesses to the severity of the distress. Moreover it is hoped that grass, in tracts carefully preserved from incessant grazing, and specially from the close destructive browsing of sheep and goats, will attain luxuriance and vigour such as, with the aid of the shade giving trees, will enable it to resist drought when the scanty herbage of the zemindar's pastures, which never gets rest all the year round, will utterly fail to sprout in default of seasonable rain.

So far it cannot be doubted that the proposed measures are practical and useful; but the misfortune is that the areas of Government property to which they can be applied are utterly inadequate to those requirements which the measures are proposed to meet. Such is, at any rate, the case in the Upper Provinces. It has been the principle of the Government from the earliest days to retain as little of such property as possible. For lands which had no owner,—waste belonging to the State,—the endeavour has been to create owners as fast as possible; and, except in the Rechna, Jechna and Sind Doabs, no such unappropriated waste any longer exists in any part of the plains of Upper India. Even actual reserves, retained by preceding Governments as such, and to which the British Government succeeded as proprietor, have been for the most part got rid of in the shape of grants to deserving persons; and there really now exist no such areas in Government possession as could anywhere be of real service for grazing purposses, on the occurrence of drought in the tracts in which they are situated.

If, then, it is proposed to avert the prodigious loss of cattle which occurs from time to time in droughts, it becomes necessary to extend the areas which can be reserved for grazing. There is no other way of saving cattle; for, though food supplies for man can be brought by rail, fodder is too bulky to bear the cost of carriage. Railway extensions are rapidly rendering human famine impossible in India; but nothing but canal extension can avert the periodical loss of agricultural resources, in the shape of plough and milch cattle—a loss which has effects almost as far reaching and ruinous as those of actual famine affecting human beings. Canals, of course, will do this in two ways; one by protecting the irrigated areas from drought, the other by affording cheap carriage for bulky commodities. Canal extension, however, especially extension of navigation canals, can only proceed very slowly; therefore more immediate measures are required for protection of cattle from famine: and the only possible measure is the extension of fuel and fodder reserves.

But how is this to be effected? Evidently the Government cannot afford to purchase the amount of land which would be required to supply fodder, in case of drought, for all the cattle of the extensive unprotected tracts. If the money could be found, no doubt the measure would pay eventually, in the immensely enhanced price at which the land could be sold when canal irrigation reached the tract in which it is situated, and thus rendered the reserve unnecessary and the land valuable. Meanwhile, grazing dues and wood sales would always pay a good deal towards the interest on capital cost. But the money cannot, possibly be found for a scheme so extensive though, sooner or later, it absolutely must be found—wherewith to buy land as reserves for military purpose near cantonments. The only alternative, then, is in the few parts where waste lands still exist in excess of ordinary village requirements—though within village boundaries—to occupy such, and reserve it for the people's benefit in time of drought. Such reserves would of coarse have to be administered in the interests of their owners. In the grazing season their own cattle, and all cattle which they passed in, would graze free of charge, and income obtained from other cattle would be credited to the owners, after deduction of actual expenses of protection. They would thus yearly reap some advantage, and in time of drought very great advantage, including much cash profit, from these reserves; and if they were judiciously managed, the owners would soon become reconciled to the measure. If not, then these areas could be taken up on rent, under the Land Acquisition Act—as, for instance, the Govesnment cattle farm Reserve at Karnal is now held

But this measure will necessarily be a very partial one; for extensive waste areas, such as are contemplated thereby, do not now exist in many districts. It might, however, be suplemented by a further measure, in which all villages shall be compelled to retain a certain proportion of common waste - where such still exists—not to be broken up without the permission of the Government. As, however, such patches of common would have to be left to the villagers themselves to look after, they would not be in any way protected; but, on the contrary, would be ceaselessly, and indiscriminately grazed—so that they would be of no value whatever in case of drought. In short, the time is long past for any general and efficient measure of protection against fodder famine by means of fuel and fodder reserves. Any measures adopted must necessarly be very inadequate and merely palliative; but still they will be useful as far as they go, and the sooner all the waste available—either existing Government reserves, or tracts reserved from, or leased from private owners—is taken in hand and protected from indiscriminate grazing, the better it will be both for the State and for the people.—*The Civil and Military Gazette.*

CALCUTTA MARKET REPORT

FOR THE

MONTH OF MARCH 1886.

Tea.]—On the 25th of February 5,475 packages out of 5,680 offered were sold in public sales. As before the demand was chiefly for teas costing under; about 9 annas per lb. At the London auctions 15,900 packages of Indian teas out of 18,000 offered were sold. During the first week of March no sales were held. The final sale of the season was held on the 11th instant when 1,630 packages were offered and sold. At the London auctions, 15,000 packages were offered and 14,000 disposed. There was a good demand for all qualities.

Wheat.]—During the week ending 1st March, sales reported amounted to about 3,500 tons April-May delivery at the following rates:—

Buxar (No 1 Club) ...	... at Rs 2-9-9
Cawnpore (No 2 Club) ...	... at Rs 2-7-9 to 2-8

Jamally at Rs 2-4 to Rs 2-5. During the week ending 8th instant 2,500 tons were sold at unchanged rates. During the next week about 5,000 tons, mostly of Club No 2 changed hands and the quotations were:—

Club (No 1)	... Rs 2-9-6
Club (No 2)	... Rs 2-8-4
Hard Red	... Rs 2-4-6
Soft Red	... Rs 2-4-9

During the week ending 22nd instant about 400 tons—changed hands at Rs 2-8-6 to Rs 2-8, for Club No 2, April May delivery. The market closed with the following quotations:—

Club No. 1	... Rs 2-9-6	April-May delivery
Do „ 2	„ 2-8	„ „
Soft Red	„ 2-5	„ „
Hard Red	„ 2-5	„ „

Linseed]—During the week ending 1st March about 4,000 tons were sold at rates varying according to the time of delivery as follows:—

Ready	Rs 4-9 to Rs 4 8
March delivery	Rs 4-5-3 to Rs 4-6
April-May delivery ...	Rs 4-1-6

During the week ending 8th instant, 3,500 tons were sold and the quotations were as follows:—

March delivery	Rs 4-3-6
April "	Rs 4-1
April-May delivery ...	Rs 4

During the next week about 2,500 tons were disposed of and quotations were Rs 4-4-6 for ready seed, Rs 4-3-6 for March, Rs 4-1 for April and Rs 4-0-6 for May delivery. During the week ending 22nd instant, 1500 tons were sold chiefly for ready delivery. Prices advanced to Rs 4-6 for small grain, 5 per cent. refraction, for immediate delivery. Quotations were Rs 4-1-6 for April and Rs 4-1 for May delivery.

Rapeseed.]—During the week ending 1st March, a small sale of Brown was made at Rs 3-2 for March-April delivery. During the week ending 8th instant about 800 tons of Brown changed hands at Rs 3-1 to Rs 3-1-6 for March delivery. During the next week from 700 to 800 tons of Brown found buyers at Rs 3-1 for March-April delivery. During the week ending 22nd instant the Market was very quiet. Buyers offered Rs. 3 for Brown seed, 4 per cent. refraction, but dealers were not inclined to sell at this low rate.

Other seeds.]—During the week ending 22nd instant about 500 tons of *til* or gingelly seeds were sold at Rs 3-10-6 to Rs 3-11. For *poppy* seed, there were sellers at Rs 3-11 but nothing was done on these terms.

Jute.]—Business during the month was confined to a few lots and that even at a decline on former rates.

CROP AND WEATHER REPORT.

For the Week ending 17TH MARCH 1886.

General Remarks.—Slight rain has fallen generally throughout Madras, and the North-Western Provinces and Oudh, and in parts of the Punjab and the Lower Provinces. Showers are also reported from Bangalore and from places in Central India and Rajputana.

In Madras and Mysore the standing crops are generally in good condition and prospects are fair. In Coorg prospects are good.

The rabi harvest has been almost completed in parts of the Bombay Presidency and is in progress elsewhere. Kharif preparations have commenced. In Berar and Hyderabad the rabi crops are being cut. In Rajputana and Central India agricultural prospects are generally good.

The rabi harvest is in general progress in the Central Provinces, and in the North-Western Provinces and Oudh. Prospects in these Provinces and in the Punjab are generally excellent.

In Bengal the standing crops have been much benefited by the recent rain, though some damage has been done to poppy and to mango and mahwa blossoms. The yield of the rabi harvest is good and that of opium fair. Agricultural prospects continue good in Assam.

Seasonable weather prevails in British Burmah.

The public health continues generarally good.

Prices are rising in the North-Western Provinces and Oudh, are fluctuating in the Punjab and Mysore, and are falling in Coorg

For the Week ending 10TH MARCH 1886.

General Remarks.—Good rain has fallen throughout the Punjab, and rain in varying quantities is reported generally from the North-Western Provinces and Oudh, from parts of Sind, the Bombay Presidency, Rajputana, the Lower Provinces, and Assam. Very slight rain has also fallen in Hyderabad and Mysore.

Harvesting continues in Madras and general prospects are fair. The crops are generally in good condition in Mysore, and the season promises favourably. In Croog prospects are good. In Bombay, Berar, Hyperabad, the North-Western Provinces and Oudh and the Central Provinces, the rabi harvet is in progress and generally promises well. In the Punjab the prospects of the harvest are considered to be generally good, and in Central India and Rajputana the standing crops are in good and fair condition.

In Bengal the recent rain has been beneficial to the boro rice and has facilitated ploughing for the aus rice, but has caused some injury to poppy. The rabi crops are generally doing well and some of them are being harvested in a good outturn. In Assam preparations for the aus crop are in progress.

In British Burma seasonable weather prevails.

The Public health continues generally good.

Prices have risen slightly in Croog and are fluctuating in the Punjab, elsewhere they are generally steady.

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Organization and Maintenance of Village records.

North-Western Provinces.—The most important work under all Provincial Agricultural Departments in India and which is now occupying their best attention is the organization of a system of collecting village records and permanently maintaining them up to date, the utility of which, especially in all non-settled districts, will be acknowledged even by the bitterest enemy of Agricultural Departments. In the North-Western Provinces and Oudh, where the Department is longest in existence, the system is already in working order. From an inspection conducted personally by the Director of Agriculture and by his responsible subordinates during the year 1884-85, the results of which are recorded in the annual report, it is evident that the beginning has been well-made, though the work done was not so efficient as could be desired. This was mainly owing to the village-staff being not properly trained and quite new to the work. To remedy this defect, the opening of *patwari schools* has been completed in almost all districts. Unless the patwaris are rendered fit by training to map out boundaries of fields correctly and turn out correct areas, there can be little hope of correct village statistics. As an instance of the kind of useful work expected of our Agricultural Departments, we may quote Mr. Smeaton's opinion on the question of the growth or decline of occupancy rights in the North-Western Provinces, based on district statistics and tahsil registers "The conclusion * * is that if occupancy right is growing, it is growing very slowly and not very steadily, and in some parts of the country, it is distinctly declining. Zemindars are fully alive to the unwisdom, from their point of view of allowing privileges to grow up and in most districts they leave no legitimate means untried to arrest their growth."

The Central Provinces.—The year 1884-85 witnessed the first practical step taken in these Provinces towards the re-organization of the staff employed for the maintenance and correction of the village maps and records, on the accuracy of which almost the whole of the revenue administration ultimately depends. In eleven districts out of eighteen the putwari staff under the settlement contract was already in existence, and in five districts out of the remaining seven, although not compulsory under the above agreement, the putwari agency was maintained. The work of the Department consisted not so much in creating the agency as in bringing about a wholesale reform, which has now given the Provinces a staff of 3,992 putwaris and 108 Circle Inspectors, the latter for the effective supervision of the patwaris. As the staff has only very lately been appointed and entered upon its duties during the current season, no details can be given of the character and progress of its work. In order to ascertain whether putwaris could profitably be utilised in filling in the interior details of maps prepared in skeleton form by a regular professional agency, a detachment of a professional survey party was deputed during the field season of 1883-84 to the Raipur district to make a trial survey. The area thus surveyed was full cadastral survey of 19 villages with a total area of 31 sq miles, block survey of 85 villages with

a total area of 169 sq. miles and traverse survey of 35 villages with a total area of 75 sq. miles. Regular operations for filling in the details of the block and traverse maps by putwari staff began however at the close of November 1884. It had for its immediate object the practical training of Civil Officers, Inspectors and Putwaris in survey and settlement work and the actual survey work was subordinated to this object. The field work continued from December 1884 through the rains of 1885, during which period there were passed 9 junior civilians, 92 revenue inspectors and 96 putwaris. The actual out-turn of field work was also satisfactory. Field details were fully filled in on the skeleton maps of 92 villages with an area of 158·5 sq. miles and in 80 of these with an area of 135·2 sq. miles *khasras* and *jumabandis* were written in addition to field plotting. On the whole area surveyed, the number of fields to the acre was on an average 2·2, the average being still more, namely 3·8, on the *cultivated area*. This added immensely to the difficulty of the survey and to the labor of record-writing. The most satisfactory feature however, of the work was its accuracy, and both the Chief Commissioner and the Director of Agriculture after a searching inspection expressed themselves well satisfied with the quality of the work done by the putwari agency. It was also found that the putwaris worked as rapidly and as accurately on traverse maps as on block maps prepared by the professional survey party. The construction of the block maps was therefore stopped. The operations described above were purely experimental and the experiments so far as they go seem to have fully borne out the hopes entertained of the usefulness of a regularly trained putwari staff.

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ASSAM.—In Assam the system of organizing and maintaining village records according to the latest rules has been begun, though as was natural in the first working out of a plan, confusion was found to exist in the numbering of fields and considerable errors in Mauzadars' measurements of areas under different crops in their respective mouzas. Steps have been taken to remedy both, but it is too early to speak as yet of the results. Intimately associated with the maintenance of village records is the efficiency of the staff employed upon them, to attain which seven survey schools were opened in 1883 and maintained during the year under notice. The cadastral survey continued its operations in the Kamrup district during the year 1884-85 and the preparation of the settlement records was in progress.

BOMBAY.—In Bombay the establishment of *Circle Inspectors* which was organized in the Dharwar district in 1883-84, was extended to the Bijapur district last year. The duties of these Inspectors consist in inspecting boundary marks, checking crop-registration by village officers and ascertaining the condition of each crop for the purpose of estimating produce and preparation of fore-cast, checking the figures of the annual census of population and stock, the entries in the death and birth registers, the cholera vaccination and other returns required by the sanitary department, the village registers of wells and other sources of water supply, inspecting Government waste land in order to check encroachments and unauthorized cultivation, making survey works, noting carefully the cultivation of staple crops, the varieties of crops and crop-mixtures, the times of sowing and harvesting, the amount of seed sown, the implements of husbandry, manures, crop diseases and the like; watching prices, trade, and wages; and supplying the Director of Agriculture with such information as may from time to time be required. To introduce into the Agricultural Department a staff of officers specially trained in agriculture, a proposal has been submitted to the Syndicate of the University of Bombay to establish a degree in agriculture, and a committee of Fellows has been nominated to consider and report their opinion on it.

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Analysis of districts with reference to security from famine.—North Western Provinces and Oudh. The first step towards making this analysis was taken during the year 1884-85. Pargana-books have been issued to all districts. In these the important statistics of each village will be ledgered annually in English by the registrar-kanungos. The work has been started in most districts. The form in which the pargana-book is cast is as follows:—On the first or outer page are recorded what may be called the permanent or *quasi*-permanent statistics of the village, viz:—

1. Name of village.

2. Population – adults: males, females; minors: males, females. { Adult-male. " Female. Minor-male. " Female. Total.

3. Total area.

4. Government demand at last settlement.

5. No. of co-sharers at last settlement.

6. Description of tenure.

7. Names and areas of constituent mahals, if any.

On the inner page are recorded the annual statistics of cultivated area, rent, revenue, rent suits, ejectments, processes for realization of revenue transfers, status of tenants, and areas under the various kinds of Irrigation. The form in which these are shown is as follows:—

1. Year.
2. Total cultivated area, as in column 6 of the milan khasra.
3. Total rent demand, as in column 6, Part I, of the mahal-register.
4. Total rent collections, as in column 11 Part I, of the mahal register.
5. No. of suits for arrears of rent.
6. No. of ejectment cases.
7. Coercive processes for realization of arrears of revenue. { [illegible]
8. No. of transfers.
9. Area of sir, and land cultivated by proprietors, total of columns 3 and 4, Part II, of the mahal register.
10. Area held in occupancy right or for more than twelve years total of columns 6 and 7a and 8a of Part II, of the mahal register.
11. Irrigated area, as in columns 2, 3 and 4 of the milan-khasra.
    - (a) From wells.
    - (b) From canals.
    - (c) From tanks or other sources.
    - (d) Total.

When the statistics of a sufficient number of years have thus been brought together, classification of districts and portions of districts according to what may be called their "famine resources" will be to a certain extent possible. A general idea at least will be gained of the comparative resources of districts. But until actual protracted drought has shown how many wells in any district give water and can be worked in the absence of the monsoon rainfall, how far canal irrigation can meet the strain of an excessive demand for water, how far the ordinary village grazing lands can be depended upon to keep the cattle alive without rain, no analysis, however complete, based on the annual village statistics, will be a safe guide. In the all-important matter of well-irrigation there is a very great deal of uncertainty A tract, which in ordinary seasons may have ample well-irrigation, may find itself in a season of severe drought without a single water-giving well, the wells may either have completely dried up or the water-level may have sunk to an unworkable depth. The Government of India desire that, besides ledgering the annual village statistics, generalizations for districts be made and shown on coloured maps. A sort of beginning has already been made in the completion of a water-level map for the united provinces, but the information which it purports to convey must be accepted with great caution.

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CENTRAL PROVINCES.—Systematic treatment of the above heading is wholly wanting in the review of the agricultural reports of the provinces, but in future years the agricultural reports will be collected and submitted in a compiled form as usual in other provinces by the Director of Agriculture.

ASSAM.—This is a province in which scarcity is unknown and famine practically impossible and hence there is nothing to record under this head.

* * * *

BOMBAY.—Fair progress in the analytical work has been made. The draft for the Dharwar district is in print. All the information that can be collected from the existing sources has been collected and put into form. What remains to be done is to check the details recorded by the help of the Circle Inspector staff, to collect additional information where the available sources are found wanting, to improve the descriptions of the cultivation of the staple crops, to prepare the necessary maps, and generally to make the analysis a trustworthy guide, such as will not only be a faithful record of present conditions, but will also direct and control the administration of famine.

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System of collection of revenue and rental in precarious tract.—With this subject the provincial Agricultural Departments have not yet been brought into connection. It must await the completion of district analysis. In Assam there being no precarious tracts, the system in not at all wanted.

* * *

Measures of protection—NORTH-WESTERN PROVINCES. The measures which now engage the attention of the local Agricultural Department are reclamation of *usar* land, enclosure of waste lands in order to foster fodder reserves, particularly in seasons of drought, cheapening the operations and improving the method of well-sinking, and arboriculture. Usar our readers may remember is a class of land not at all uncommon in the United Provinces

which for excess of saline matter as is usually believed in the surface soil is quite unfit for cultivation and towards the reclamation of which the attention of the Agricultural Department has long been directed. For the last five years experiments were conducted on the estate of Awa, the results of which have shown that usar grass can grow on bad usar if cattle are kept off, that where usar grass grows it is useless to plant *babul* trees, that in every usar plain there are patches of land only slightly infected mixed up with the bad usar, that in the slightly infected patches *kikar* trees grow fairly well, and that the Australian salt-bush, *reonja* and *chaunkar* gave promise even in bad usar. It would be a pity to surrender the experiments just at present after so much labor and expense had been incurred, simply because the estate has now passed out of the Court of Wards. To demonstrate on a large scale, the results of the successful experiments on a small scale at Awa, two large blocks of *usar* were acquired near Aligarh by the department in 1884-85 and placed in charge of the specially trained agriculturist Mr Muhammad Hossein. There are also two other experimental plots at Cawnpore which have not yet shown any very great result. The *reh* survey was still in progress and was not completed as expected by the middle of last year. To give a trial to the question of fuel and fodder reserve, Mr Duthie, Superintendent of the Shaharanpur Botanical Gardens, made a tour during the last cold weather months in the Jumna ravine tracts with the double purpose of reporting on the flora of these lands and of ascertaining what sort of fodder grasses and trees might be expected to thrive on them. The results of his observations have not yet been published. Endeavour was also made during the year to encourage the use of boring apparatus in the construction of wells, which apart from other benefits, is excepted to prevent useless expenditure of money. There were in all nine sets of boring tools in use in the United Provinces during the year and they were energetically worked. The Director of agriculture hopes their use will extend. Under arboriculture it is enough to state that the total expenditure during the year amounted to Rs 68,526 and the receipts to Rs 33,830, the total net expenditure to Government for maintenance of avenues, groves and nurseries being thus Rs. 34,696.

BOMBAY.—In the year 1883-84 extensions of *babul* plantations were expected through the appreciation in England of the merits of *babul* pods for tanning purposes. But no such extension actually took place during 1884-85. The results of the *rab* experiments have not been discussed in the annual report but they are well known to the readers of this journal. Of all measure of protection, irrigation undoubtedly comes foremost. The Government of India expressed the desirability of encouraging the extension of well-irrigation by reducing the cost of wells and lifts and building wells in places when there were none, and brought to notice the work done in the united provinces in this direction, which we have already described above. One experienced engineer was therefore deputed to inquire whether assistance in the methods of sinking and building wells can be offered, and to find out the feasibility of improving indigenous water lifts, and the utility of recording depths of water level. The results of his investigations show that no machinery in the shape of boring tools or dredgers is of any use as a rule to the ryot, that they are conversant with and do make use of when necessary a very cheap method of well making which it is impossible to improve upon, that the native water lift or *mot* is more efficient than any other water-lift which has yet been tried in the country, and which at the same time as regards cost and suitability for adoption can compete with the *mot*. As regards hydrographic survey to record the depths of water levels on village maps, the opinion seems to be that it would be of no help to the ryot of Gujarat, for he does not require it; or to the ryot of the Deccan, because the level is so variable and the surface of the country so uneven that the cost would be totally incommensurate with the results secured. In Assam protective measures are unnecessary, because famine is unknown, while in the review of the Central Provinces' Agricultural report, no mention has been made of adoption of any such measures.

* * *

Agriculture including experiments and farms.—NORTH-WESTERN PROVINCES. In April last, with the sanction of Government, a small "Demonstration" farm of about 20 acres was established at a convenient place three miles from Meerut and close to the scene of the annual "Nauchandi" Agricultural and Horse Fair. The object of this farm is to show in actual operation on the land of an ordinary holding such improved methods of tillage as have been proved by experiment at Cawpore to be of real value and to be within the reach of any cultivator. The principles on which the farm was to be worked are—(1) that it is to pay its own way; (2) that it is to be managed by a committee of agriculturists of the district with a working

Superintendent appointed from Cawnpore. At the Cawnpore Agricultural Station various crop, manure and other experiments were conducted. Of manure experiments the most noticeable was the success obtained with wollen refuse, a material which has hitherto proved to the Mills in Cawnpore a serious incumbrance, as it has been difficult to get rid of, and, if left to accumulate, is dangerous from its liability to spontaneous combustion. It is now shown practically to the Indian cultivator to be a valuable material for his crops—a fact, it is needless to mention, well appreciated in England. Next in value stood poudrette and then cowdung manure. Nankin cotton continued to receive considerable attention and three varieties were under experiment. The system of cultivating small carefully measured and cultivated plots of every important kharif crop, the produce of each being carefully weighed so as to obtain annual approximate data of crop yields, was continued with good results.

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As in the kharif woollen refuse came prominently to the front in value, while as the manure most generally available and giving, perhaps, the best result on expenditure, farmyard manure maintained its wonted superiorty vindicating so far the prescience of the Indian cultivators; but the experiments also go to show how the cultivator neglects much material which now goes to waste rather than incur a little extra trouble. In this category may be classed brick-kiln refuse, cutting and pitting weeds green during the rains or cutting them just before the seed ripens and burning them for ash-manure, instead of allowing them to seed and scatter over the country. Experiments on the system of cultivating corn in strips with alternate fallow strips, experiments in irrigation, experiments in canal or well irrigation and experiment and enquiries in regard to the change of colour effected in wheat by various classes of soil, all received attention and contributed data of value. Of experiments appearing for the first time may be noted plots sown to test the value of mixed crops of cereals and oilseeds, which so far indicate that the practice affords a larger combined outturn than if the crop were confined to cereals or to oilseeds alone. Another series of 10 plots gives for the first time a comparative view of the yield and profit on a similar number of oilseeds and pulses in which for the year castor takes the lead and linseed the lowest place.

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Central Provinces—The experimental harvestings which were made during the year mark a new departure in the Revenue Administration of the Provinces. Very few Revenue officers had any practical knowledge of the out-turn of the land, and the information which was from time to time submitted to the Chief Commissioner on this subject, was palpably incorrect. Deputy Commissioners and their Assistants were requested to make each year a number of trial harvestings of various kinds of crop, and detailed instructions were given for the conduct of these harvestings. The experiments were to be of two classes,—one conducted on fields which had been selected and set aside as "permanent exemplars" (and which were to be harvested in this way every year,) and the other conducted on fields specially selected as of average quality by the officer making the experiment. The former class of experiments would, if feasible, have the advantage of showing the out-turn during a series of years *from particular plots of land,* and would, it was hoped, afford a basis for calculating the relative productiveness of different seasons. The latter class of experiments was however discontinued owing to the difficulty met with in its practical working. The review of agricultural reports by the Chief Commissioner does not deal with any other agricultural experiments excepting the one mentioned above or farms, but our readers are already aware of the important experiments that were conducted during the year in the Nagpur experimental farm and their results from our own review of the report of the farm sometime back in the pages of this journal. Of the different heads under which the review appears, the most important and at the same time the most interesting is the one of "agricultural conditions of the year." The year was characterized by an extraordinary heavy rainfall, but the cessation of rains in October and November retarded wheat sowing, and injured more or less all other crops. In all districts excepting Nimar and Chhindwara, the year was a disasrous one for all khariff crops except rice. The season was fairly suited to the sugarcane crop, the juari and the cotton crop yielded exceedingly poor out-turn. The rabi harvest on the whole was only a moderately good one. Wheat suffered most but gram succeeded much better. Linseed promised well but yielded poor out-turn. The health of the people was much better than usual. A comparison of the percentage of cropped to total area in each district is very interesting, being highest, viz 61, in Hoshangabad and lowest, viz 23, in Mandala and Sambalpore. In most districts cultivation can be extended much beyond its present limit. The character of the crops grown in different parts of the Provinces varies very greatly as might have been expected

from the heterogenous tracts of which the Provinces are constituted. In the district of Balaghat, Bhandara, Raipur, Bilaspur and Sambalpore, over 60 per cent of the area is under *rice-crop*. *Juari* is of most importance in the hilly districts lying to the west of the Provinces and in the district of Wardha, Nagpur and Chanda, which are also the districts in which *cotton* is chiefly grown for experiment. *Wheat* covers over 60 per cent. of the total cultivated area in Hoshangabad and Saugor, *linseed* attains its greatest importance in Wardha and Chanda, and *sugarcane* is not very extensively grown in any district except Sambalpore. There were outbreaks of reinderpest and pleuro-pneumonia in several parts of the Provinces. A good clue to the extent of morality is given by the statistics of the traffic in hides. The increase in the exports of hides from the Chhatisgarh and Raipore divisions as compared with that of the previous year represents an excess of mortality of about 1,31,000 heads of cattle in the former and of 13,000 heads in the latter division.

BOMBAY.—The main features of the Bhadgaon and Haidarabad Government farms during the year under notice have already been discussed in the pages of this Gazettee and need not be repeated here. Besides these two, there is a farm of 70 acres attached to the Poona College of Science and another private institution of some years' standing known as the Nadiad Farm, supported entirely by a local committee of agriculturists. This is an instance for Bengal to imitate. Of the special experiments, those on rab have been fully reported in these columns. Of the experiment on indigenous and exotic crops, wheat, tobacco, and cotton deserve special notice. To improve the staple of wheat, steps were taken to distribute throughout the presidency hand-picked selected seeds but later experience and maturer considerations made the Director of Agriculture change the plan. The use of selected seed must be taught by the progress of wheat export. As to the influence of altered conditions of climate, soil and rainfall in changing the consistency and color of wheat, experiments are in progress to determine the point. That both are variable is the popular belief and so far as experiments have gone, they tend towards the same direction. The change of color is apparently not so rapid as that of consistency. The subject is under investigation in almost every province of India, but the popular belief in every part of India where wheat is largely grown seems to be that however careful the cultivation might be, altered conditions of soil, climate and rainfall have a tendency to bring about change from white to red and from soft to hard sample. Mr. Smeaton in submitting the annual report of the Cawnpore Agricultural Station remarks "clay-soils appear to have a tendency to redden the color of wheat." The net result of all experiments to improve the staple either by distribution of seed wheat collected from favoured localities or by importing pedigree seed from abroad is that there is not any well founded hope of improving the staple by this means. One of the most effectual means of improving the export of wheat is, according to the Director of Agriculture, the introduction of steam machinery. In his annual report he says "my endeavours to induce a large firm to enter into the trial have been successful. A full description of the trials has been published in the 1st number of the *Indian Agricultural Gazette*." Under cotton, the various points noticed and described are the Dharwar Experiment, Egyptian cotton, saw-gins, want of fresh seeds from American cotton market, prospect of American cotton, Khandesh cotton, and Nankin cotton.

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Government sanctioned a grant of Rs. 2,500 for a further experiment in tobacco-curing at Nadiad in the Kaira District. The experiment was conducted by Mr. Bechardas Veharidas Desai in consultation with the Collector and in communication with the Director of Agriculture. The services of Mr. John, who was employed last year as curer were also secured. Curing did not begin until the setting in of the monsoon, for want of sufficient moisture. The process took about three months. The final report on the subject has not yet been received; samples of cured leaf, in boxes of five pounds each, have been recently sent for further opinion to the leading firms of England and Ireland whose opinions were received last year, and also, by the kind offices of His Excellency the Governor, to well-established firms in Holland and to the Austro-Hungarian and Italian Consuls. In order to test its actual worth in the European market, arrangement has been made to send to England five bales of the cured leaf, each of 250 pounds, to be sold there through a firm of brokers. The price thus fetched will be a more valuable guide than the mere opinion of experts in developing the Nadiad industry. Mr. Desai purchased at his own cost a tobacco-cutting and cigarette-making machine from Bombay. With the help of this machine, smoking tobacco and cigarettes have been manufactured for sale in India. The question whether manufacturing can be profitably carried on is thus being tested.

The cultivation of sugar has so extended that the price now obtained for *gur* is almost prohibitively low. A sugar-factory was established in Poona in 1888 and produced excellent sugar, but the enterprize is languishing, simply because the necessary by-product-rum-can not be disposed. The subject of a second attempt to introduce the manufacture of sugar from date palm has received full attention but the Government does not seem disposed to take any active steps in the matter. On the subject of native manufacture of sugar, the Director of Agriculture writes. "Coarse sugar is manufactured in Kolhapur and in parts of the Belgaum District. A short, but careful, description of this rude process was given by Mr. W. S. Price, Assistant Settlement Officer, in the 4th number of the *Indian Agricultural Gazette*. The process is clearly susceptible of very radical improvement. It will be seen whether the Cook's evaporator which will be tried at the Bhadgaon Farm will show itself worthy of use for cane sugar."

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ASSAM.—Besides experiments to determine the average out-turn of staple crops, those for testing the amount of sugar obtainable from an acre of are by far the most important. The result may however be thus summarized. The weight of *gur* per acre is 2,350 lbs; cane yields between 39 and 42 per cent. of its weight of juice and between 8·18 and 8·76 per cent. of its weight of *gur*. The juice yields between 20·54 and 20·70 per cent. of its weight of *gur*. To institute a comparison with products elsewhere, it is necessary to recollect what is meant by the word *gur*. *Gur* in Assam is not a hard compost like that known in Upper India. It is a syrup more or less thick, containing crystals of sugar. It is never worked up into hard balls, but is sold in earthen pots. *Gur* in Assam retains a good deal of the water contained in the raw juice. *Gur* in Upper India, retains none. In the Punjab the following figures are believed to approximate to the truth :—The weight of *gur* per acre is 1,558 to 1,640 lbs. Cane yields about 59 per cent. of its weight in juice and about 10 per cent. of its weight in *gur*. Juice yields about 24 per cent. of its weight in *gur*. In Burma the estimates are as follow :—The weight of *gur* per acre varies from 2,482 lbs. to 3,452 lbs. Cane yields about 48 per cent. of its weight in juice and 8 per cent. of its weight in *gur*. Juice yields about 18 per cent. of its weight in *gur*. In the North-Western Provinces the following figures have been given as approximately true :—The weight of *gur* per acre is 2,460 lbs. Cane yields 50 per cent. of its weight in juce and 9 per cent. of its weight in *gur*. Juice yields about 18 per cent. of its weight in *gur*."

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AGRICULTURAL IMPROVEMENT.—One of the means of introducing agricultural improvements is the holding of annual agricultural shows under a system of rules and regulations which would foster inter-communications between the agriculturists of different provinces. Agricultural and cattle fairs under local management are not at all uncommon in India. The idea is not foreign to the people as some may think. What is wanted is the encouragement, development and direction of the indigenous local fairs. The hands of the provincial as well as imperial Agricultural Departments should be strengthened for this purpose and in the words of Mr. Ozanne "the Agricultural Department can not do better than imitate the example of the Royal Agricultural Society of England." We should strongly press on the Government the suggestions of Mr. Ozanne on this subject. Besides local and provincial Shows, we should propose inter-provincial shows to be held at stated intervals in each province alternately at places to be selected each time by the Imperial Agricultural Department. While on this subject we can with advantage quote from his annual report the remarks of Mr. Smeaton on the abuse of agricultural shows. "A mere exhibition of new implements or labour saving contrivances at a fair is not sufficient. The people will not throughly believe in them till they see them working on their homesteads in their own way. The work of awarding prizes at some—indeed all—of the fairs for agricultural produce was not found satisfactory. People entirely unconnected with agriculture were found winning prizes for produce which they had evidently purchased from the grower. Zamindars were found taking prizes for produce which they exhibited, but which had really been grown by their tenants. I found also many prizes being given to the Department of Agriculture and Commerce for Cawnpore-grown produce. In one case I found that a police constable had earned a prize for wheat, although he had never handled a plough in his life! These are all abuses; and I took the opportunity of explaining to the committee that in allowing such they were really defeating the end for which fairs have been established. The prizes for agricultural produce rarely reached the actual grower. This was the cardinal defect in the management, and a very serious one, indeed."

* * *

MISCELLANEOUS.—The other heads under which the reports have been thrown are too numerous

to be given in detail here. But the sketch given above will be incomplete without a conspicuous notice taken of the four well got-up and neatly executed maps with which the annual report of the Agricultural Department of Assam has been accompanied. They illustrate in colors for the Brahmaputra valley the following points. (1) The percentage of tea to the total cultivated area of each district. (2) The percentage of rice to the total cultivated area of each district. (3) The percentage of mustard to the total cultivated area of each district. (4) The percentage of cultivation to the total area of each district. No figures are obtainable for the hill districts or the Surma Valley, as no statistical agency exists in that portion of the Province. This is the reason why no cotton map was attempted, for this commodity is almost entirely grown on all but the highest portions of the main central range. In the maps, however, there is one thing needed, namely, the numbering of colors, which will make them easy for reference. Colors, however sharply defined, are not unoften difficult to distinguish. The addition to the colors of, say, Roman numerals will entirely obviate this difficulty. If precedents are wanted, we might add that statistical maps like these are always colored in Belgium, France, England etc. and invariably the colors are numbered.

* * *

ENGLISH POTATOES IN BENGAL.—Mr. A. C. Sen, ·. S., on agricultural duty in Burdwan, in sending some vegetables for exhibition at the Agri-Horticultural Society's annual show made the following remarks:— I am sending a few varieties of potatoes, which have been raised from seeds supplied by yourself. As regards the potatoes, my success would have been better if I had planted them in time. They were all planted too late, and even a week's difference in time of planting makes a great difference in the yield, etc. This is especially the case in Bengal where the whole potatoe growing season is comprised within 4 months. From my limited experience I am rather inclined to conclude that even in the plains, importing good seeds from England would be a great advantage. Comparative experements shew that English seeds do much better than the country seeds when planted under the same conditions. As regards the apprehension of importing diseases, especially the potatoe blight, I can only say that I distributed English seeds among ryots in over 30 places for planting, side by side, with country potatoes, and the news coming from those places is invariably the same, viz., that they gave the healthiest of plants, which did not suffer from a disease known as Dhasa among the cultivators, which has this year destroyed hundreds of potatoe fields. In reply to some enquiries Mr. Sen continued.—Most of the potatoes raised from English seed, I shall be able to sell as seed, and therefore at a price which will pay the cost of importing from England. I think it very desirable that in the plains seed should be changed as frequently as possible, say every third year. For this, we may use either seeds brought down from the hills, or English potatoes acclimatized at a well managed farm, preferably at or near one of the hill stations. Potatoes are very largely grown in the Hooghly and the Burdwan Districts, but I do not think it is generally known, that over fifty per cent. of the cultivators use as seeds, such diseased potatoes as an English farmer would hesiate even in throwing to the pigs.

SUGARCANE IN BURDWAN DIVISION.—Mr. Sen mentions that he intends carrying out a series of experiments with Sugarcane, one of the most important crops in the Burdwan division, to ascertain the manure, culture and variety best suited to different localities, and asks for cuttings of some good kinds. The Society has a small quantity of imported varieties of cane in its garden which are being propagated with a view to distribution when there is sufficient stock; these not being available at once, the Deputy Secretary applied to Mr. M. H. L. Gale, Pundoul Factory, Durbhanga, for cuttings of a variety grown there, where it has been preserved since what are known as the Old sugar days, 1830-40, when there were large European sugar Factories in many parts of Bengal. Mr. Gale writes that the cane he sends is called "*cheena*"; that grown by the Ryots from which Rab is made, which is converted into sugar, is called "Bhoorlee," but this variety is not generally cultivated save in one particular part of Durbhunga district; the kind generally grown is called *Nargorie*, from the juice of which *Gur* or jaggery is made, but not *Rab*. Mr. Gale says that in Chupra, varieties known as *Borunk*, *Narkatta* and *Keola* are cultivated besides *Nargorie*, but only *gur* is made from their juice. The cuttings of the "*Cheena*" variety received from Mr. Gale were sent to Mr. Sen. The information Mr. Gale gives as to the different methods of treating the juice of different canes, is very suggestive, and a careful analysis of the juice of the different canes is very desirable; it would probably be found that the varieties used for making *gur* are deficient in sucrose, though they may contain an abundance of juice. This depressed industry

would no doubt benefit by careful enquiry on these lines, and a diffusion of the knowledge thus gained.

1. Report on Arboriculture in the Hyderabad Assigned Districts for the year 1884-85: From Government of India.
2. Memoranda on the prospects of the Indian Wheat Crop of the season 1885-86, of the Wheat and Oilseed Crops of the North-Western Provinces and Oudh for February 1886 and of the Wheat Crop of the Punjab for January 1886: From Government of India.
3. Wheat Forecast of the Bombay Presidency: From Director of Agriculture, Bombay.
4. February Forecast of the Wheat and Oilseed Crops of the North-Western Provinces: From the Director of the Department of Agriculture, North-Western Provinces.
5. Proceedings of the March meeting of the Agricultural and Horticultural Society of India: From Secretary.
6. Report on the Cawnpore Agricultural Station for the rabi season 1884-85: From the Director of the Department of Agriculture etc., North-Western Provinces.
List of Agricultural Implements in the Bombay Presidency: From the Director of Agriculture, Bombay.
8. Report on the Railborne Trade of Assam for the quarter ending 31st December 1885: From Government of Assam.
9. Returns of the Railborne Trade of the Punjab for the quarter ending 31st December 1885: From Punjab Government.

Thanks of the Editor are recorded for all the above contributions.

FLAX IN BELGIUM.

THE great importance of flax in all Flemish rotations is at once evident. Hemp finds, on the contrary, a very limited and gradually narrowing area in the country. Both hemp and flax are largely grown in India, the first for its fibre, the second almost entirely for its seed, mostly destined for exportation. It is a regrettable and no less curious incident in the history of India that the Hindus, who were probably the first to utilize flax for textile fabrics, should entirely forget its use as such, and that our flax fields should not produce any fibre, but be wholly consecrated to the growing of the seed. No such thing as Indian linen now exists, it having disappeared in all likelihood before cotton and other fibres which time has discovered among the rich flora of the great Asiatic peninsula. The writer of the article on Fibrous Substances in Spons' Encyclopædia of Manufactures and Raw Materials says:—Within "the last 200 years flax has entirely lost its ground "(in India) as a fibre plant, being reduced to a "stature of no where more than 18 inches, and "sown and cultivated in such a manner as to "produce bushy dwarfed plants, the sole object "being the oleaginous seeds. The plant is largely "grown in Bengal, Behar, Oude, Bombay, the "Punjab, the North-West Provinces, and Madras. "There is an abundance of land available, but "it is doubtful whether the heat of the climate "would favour the production of fine fibre, and "it is certain that the natives would not relinquish "their modes of culture for the sake of the seed, "without assurance that the fibre would be equally "remunerative." I am fully confident that the cultivation of flax for its fibre may be revived with success, if a well-directed stimulus be afforded to its growing, and a better knowledge of its culture spread among our peasantry. The district of East Flanders, called the Pâys de Waes, enjoys a great reputation for its linen. I have, therefore, thought fit to add below an extract from the report of M. De Deukerghem, on the mode of flax culture there in use:—

"A strong manuring is given to the land destined for flax in the preceding year. Towards the beginning of March the soil is ploughed up with a Flemish plough, having a broad mould board, and is next treated with 12 tons of liquid manure per hectare ($2\frac{1}{2}$ acres). The soil, being very loose, is next beaten down. Sowing takes place from the middle of March to the middle of April, at the rate of $2\frac{1}{2}$ hectolitres of linseed per hectare ($2\frac{1}{3}$ bushels per acre). There are actually various grains in the market; that of Riga is the best, and sells for 40 to 50 francs per 72 litres (22 glls.); Dutch seed from 35 to 40 francs per 106 litres; the seed of white-flowered flax sells for much less. The seed is slightly covered up by two harrowings with a light harrow or a Flemish *rubob* or brush harrow. The soil is next beaten down a second time, either by the feet or else by means of a simple instrument consisting of a heavy rectangular plank furnished with a vertical handle.

When the young plants are 3 or 4 centimetres high (1 inch), five or six women, often as many as 30, according to the area of the field, go upon their knees and weed away all parasitic plants with the greatest possible care. The weeding is done a second time when the plants are a little higher. . . . The produce of flax per

hectare is estimated at 900 kilogrammes of fibre (1,980 lbs.); besides, the white-flowered variety gives 7 hectolitres of linseed, while the Riga scarcely 5 hectolitres, as it is harvested before the seeds have well matured. . . . When the flax is harvested, it is put in small bundles; the capsules containing the seeds are next detached by means of a comb with iron teeth, through which the bundles are repeatedly passed. The grains, being not fully ripe, are dried in the sun on a cloth, next threshed, and sold to manufacturers of oilcake.

"The steeping or 'water-retting' of green flax has existed in Flanders from very early times. It takes place either in canals specially devoted to that purpose, or in stagnant pools and tanks. The bundles of flax are placed in beds one over another, and finally weighted down under water with stones and turf. The duration of steeping varies according to the temperature of the water. The flax is taken out when the fibre easily detaches itself from the 'boon' or stem. Dry flax is steeped much more rapidly than green flax. After it has been retted, as indicated above, the flax is spread over a field or meadow to whiten. It is turned every two or three days, till each side has got the sun three times. When dried and bleached in this way, it is put in small bundles, and stored up under shelter."

The stripping of the fibre is universally done by labourers or poor peasants, who having not much else to do in winter, occupy their time usefully with this pursuit. They buy off the flax as it stands on the field from the farmer, who thus disengages himself from a task which exacts an amount of labour and patience equal only to the needs of the uncomplaining and honest cottager. This fact of the manipulation of the straw forming a distinct industry ensures more skill being brought to bear, and accounts in a great measure for the superiority of the Belgian flax. I now let M. De Deuterghem speak himself :—

"In the first rank of Agricultural industry should be placed the srtipping of flax, which brings a certain degree of comfort in the household of the labourer. . . . . Formerly, the straw used to be beaten and broken into pieces by a mallet, which was made of a rectangular piece of wood, fluted inferiorly, and provided with a handle on its superior surface. It was about 10 inches long, 5 inches broad, and 3 inches thick. Its use becomes rarer every day, as excellent mechanical 'breakers' (*brayeuse*), recently introduced, have made possible a great economy of manual lobour. The 'breakers' most in use are those of which the two fluted cylinders fit into each other, and are themselves supported on cushions of India-rubber. This arrangement permits the upper cylinder to rise or fall in proportion to the quantity of flax that has been introduced. The whole is carried on an iron framework, and provided with two wooden platforms one on either side, over which the flax moves to and fro as it is being broken. The workman spreads a handful of flax on one of the tables, and then presents it between the cylinders. These latter turn one upon the other, and thus carry off the flax between them. A few turns of the crank forward and backward suffice to thoroughly break the woody part of the stem.

When the straw is thus broken into small bits, the workman takes a handful of it and shakes it, to disengage as much as possible the short chips of stalk, and thus to make the bundle a little more supple. This done he places the bundle across the handle of the 'decorticating plank,' holding the former in his left hand. The latter is a vertical plank about 5 feet high, 1 foot broad, 1 inch thick. It is held upright and steady on a long heavy plank, which serves as its pedestal. At about a yard from the ground it is notched, the notch being about 3 inches high and 5 or 6 inches deep, in a slightly oblique direction. The flax being introduced into this opening and grasped tightly in the left hand, the workman passes the 'ecang' or 'decorticator,' held in the right hand, up and down the length of the fibre. The decorticator has a very strange shape: it is made of walnut wood, which takes a high polish. Each handful of flax is made to undergo two beatings, so that it may be worked evenly throughout its whole length. Between the two beatings it is passed lightly through a wooden comb, with a view to take the stemmy matter off the ends, where it is more adherent as a rule.' The second beating continues as long as the fibres have not acquired the desired suppleness and lustre. When the flax is fine and the fibre strong, the artisan gives a third beating to augment the lustre. Dressed with a leather apron, he next holds the flax extended on his knees, and repeatedly passes a sort of blunt wooden knife along its length, and thus gives the fibre its last dressing.

"In the last five years the use of the decorticating mill has become very frequent. This machine consists of several 'decorticators,' or thin narrow strips of plank arranged *radially* on a wheel. They pass regularly in succession before the notch of the decorticating plank. The wheel is given motion to by the feet of the workman, through the medium of a crane-work system. Machine-decorticated flax re-

ceives always a last dressing by the hand, in order to have more aspect and lustre. Machine decorticators are said to weaken the fibre; to this, with some reason, as well as to the more and more general use of the white-flowered variety, is attributed the gradual fall in price of the flax of the Pays de Waes.

From this extract out of the annex of M. de Denterghem to the Report on Belgian Agriculture by Mons. Emile de Lavelaye, some idea of the cultivation and preparation of flax can be formed. It rests, in connection with this subject, to note a few other important considerations from the purely agriculturist's point of view. First, the fineness and strength of the fibre, which constitutes its two main qualities, depend to a large extent on the original seed. The seed imported from Riga in Russia enjoys a unique reputation in Flanders in this respect. The Belgian Government, solicitous of the welfare of linen industry, has ordained several laws, having for their aim the importation of the Riga seed and the guarantee of its purity. The dishonesty of exporters of flax seed has latterly produced deplorable consequences; the State is, therefore, taking measures to repress their fraudulent manœuvres. It may be added, by the way, that different soils require different seeds to produce the finest fibre. Thus, while the Riga recommends itself to the light soils of Flanders, Dutch seed is considered the best for the heavier soils of *polders*. Secondly, with regard to the quantity of seed, it should be remembered that heavier seedings are necessary when the flax is grown for the fibre than when for the grain. With light seedings, the stems branch in all directions, and are thus spoiled for the fibre; on the other hand, they become so much prolific of seed. Thirdly, regarding manuring, Mons. Petermann, Director of the Agricultural Station of Gembloux, in a report to the Minister of the Interior says:—"It matters not only to secure a heavy " crop of fibre, but to have it of good quality. For " this, an appropriate manuring should be had re- " course to. It is known for a long time that on " guano the flax has more of hair and less of fibre " The soil should have a manuring more general " than what guano supplies. Manures containing " above all potash and phosphoric acid are those " most propitious for the quality of the fibre."

The cultivation of hemp does not present much interest. Note should be taken of the fact that in the growing of hemp fibre Indian seed is highly esteemed in Flanders. Hemp tends to disappear more and more, and is confined now only to a few districts, where it is still cultivated for domestic purposes. The neighbourhood of Termonde, along the banks of the Salt, bears a cosiderable acreage of hemp.

B. C. Basu, B. A., M. R. A. C., etc.

GENERAL AGRICULTURE IN BELGIUM.

According to official statistics a third of the cultivated surface of the country is devoted to catch-crops. It is as if the total area available for agriculture is increased by a third. It is a marvellous conquest over nature obtained by force of labour, care and outlay. Turnips and carrots are the two principal crops, *stubu*, in Flemish rotations. They yield abundant green food to the beasts in winter and thus help the production of milk much better than if the animals are fed on dry food. The system of permanent soiling (*stabulation*) in general practice in Flanders demands forage and roots throughout the year. Thanks to its intensive culture, Flanders maintains more live stock than any other country of Europe, England included. On this point, the figures quoted from the International Statistics of Agriculture, by M. de Lavelaye, are very interesting, thus:—

For every hundred hectares.—

		Flanders.		England.
Horses	...	9	...	9·1
Cattle	...	62·2	...	25·7
Sheep	...	14·7	...	125·5
Pigs	...	38·0	...	10·8

"Reducing the two sides into eqivalents of cattle " at the rate of three sheep or four pigs for one " head of cattle, we arrive at the result that while " Flanders supports 82 heads of cattle per 100 hectares, England has but 42." An agriculture thus pushed to the extremity of its productive power necessarily demands a considerable capital. Thus while the active capital on a large English farm seldom exceeds 12*l*. per acre, it is ordinarily between 14*l*. and 16*l*, on the small *exploitations* of Flanders.

A very evident interesting feature in the preparation of arable land consists in the dressing up of the field in beds from two to three metres broad, divided between furrows made with the plough, or more often with the spade. The earth thus dug up is spread over the beds, so that they assume a slightly convex shape, and thus drain themselves quickly after a heavy shower. A no less useful and interesting practice is found in the drainage of pastures by means of a series of ditches—about a yard or so deep—ramifying through them. These carry

away superficial water, as well as a part of water of filtration, into the nearest brook or canal. The practice of trench draining in Flanders dates from remote times. It is said to have been thence introduced into England in the middle ages.

The foremost among the lessons which we may learn from the Flemish peasants is that of manuring. The poor sands of Flanders could not sustain an agriculture, undoubtedly the most intensive in Europe, without energetic employment of manures of all kinds. The peasants show a wonderful talent and activity in utilizing everything that may force the growth of vegetation. Farmyard manure is, in the first place, very abundant owing to the numerous cattle kept on the farm, and is, as a rule, better managed than perhaps any where else. On this subject, M. de Deuterghem writes :—

"The care bestowed upon farmyard manure by our cultivators can be equalled but never surpassed. On every farm, large or small, there is a special place appointed to receive the farmyard manure. Generally it is surrounded with a low wall of brick or stone which serves to isolate the heap from the neighbouring ground. Intelligent and enthusiastic farmers have often built covered sheds to receive the manure. In many cases the dungheap is made in front of the sheds, so that it is daily trod upon by the cattle as they leave or enter their habitation. Everywhere are to be seen pits destined for liquid manures, consisting of the urine of farm animals and the drained juice of the dungheap. When spread on the fields they form a very quick and active manure to the young crops."

Besides the dungheap and the liquid manure pit, we often find trenches or cisterns specialy constructed to receive and conserve the nightsoil of towns before its employment on the fields. In all Flemish towns it is prohibited to put closets in communication with sewers; but they are made to empty in pits below. The contents are sold off at frequent intervals to peasants of the neighbourhood at the rate of 2*d.* to 3*d.* per bushel. All the elements borrowed from the soil are thus restituted to it. Children are often sent out on high roads to collect the chance droppings of horses and cattle. In the art of manuring more than any other, Monsieur Emile de Lavelaye claims the palm for his own country with perfect justice. At a time when there was very little science, and no scientific teaching, Flanders stood out the only country in Europe where one of the fundamental doctrines of agricultural chemistry was reduced to the level of every-day practice. "The doctrines of Liebig," says the learned economist, "are applied here in practice with as much care as in China."

Besides, composts are made of aquatic plants taken out of ditches, ponds and streams. These are enriched by mixtures with the mud of canals and tanks, with the refuse of tanners, with lime, ashes, beet-root pulp, road clearings and various other substances which experience has taught the peasants as of any value. Phosphates, ground bones, oil-cakes, guano,and numerous other chemical manures are also largely utilized.

Talking of manures and peasants, I happen to be reminded of some strange beliefs known to exist in the official world with regard to Indian agriculture. A stock saying with some is that India is not yet ripe for agricultural reforms. All reformations, from those religious revolutions which raised the heathen world from darkness to comparative light, through the slow but always advancing reforms of feudal days down to those of modern times, the abolition of the slave trade, the anti-corn-law reforms, the various wars of independence in the old and the new world, were each and all denounced as measures out of time and out of place. Yet there are few now who, looking back at the vast amount of good which they have wrought, can doubt that times were not ripe when these reformations were making their way. So with regard to the indifference, nay positive discouragement, which some people, including a few who carry enormous weight in politics and with public opinion, manifests in respect of the future of Indian agriculture. I would certainly hesitate twice before contradicting them, if what they say had been grounded solely on political and economical considerations. But as it seems to be mainly founded on a belief in the incapability, on the part of the Indian peasantry, of appreciating the use of scientific improvements, I find myself constrained to join issue with those who harbour and give expression to such belief.

The introduction of chemical manures is, no doubt, the greatest triumph of agricultural science. If now, as it appears to me, the peasants of Flanders and Vaucluse, innocent as they are of all but the very rudiments of learning, not to say of the secrets of agricultural science are, the most enthusiastic in the use of manures, what reason have we to suppose that our Indian peasants, whom no one has ever accused of either dullness or indolence, will refuse to utilize them, if their great utility is once presented to their observation? Does not the ryot plough? Does he not weed his field? Does he not know that the ploughing and weeding will give him a better crop, and if he did not do them he will get very little crop? The *ryot* who will answer to these queries fully as well as a Flemish peasant, or, may be, as a British farmer. Will he be slow to answer to himself to the questions

—Do manures give better results ? Are they economical and within his means ? If I was asked such a question, I should certainly reply to it by a decided no. If the increase of yield by manures pays a trifle more than the outlay in their purchase, the *ryot*, when once convinced, will not fail to take advantage of them, nor will he long lack in intelligence to know their proper use.

Among agricultural implements in general use in Flanders, there is none to take any special note of. They are generally of the simplest construction, depending for their making and repairs on the skill of the village blacksmith. Many are improvised by the peasants themselves, conformably to the purposes they are required to serve. The Flemish *raboh* or bush-harrow, the soil-beater, the flax-tools, with numerous others, belong to this category, but primitive as they are, they work admirably in the hands of their masters. Ploughs, harrows, rollers, etc. of the improved type are rare, the only exception being, as in France, the general introduction of locomotive threshing machine. Of all agricultural implements, the Flemish farmer values the spade most. On the smallest class of farms, ranging from one acre to five or six acres, the plough does not find sufficient occupation ; and even on larger farms where horses may be kept, the soil is dug up deeply every five or six years by the spade. A familiar proverb of the Flemings, " The spade is the gold mine of peasants" well attests the high esteem which this primitive invention of man still enjoys in Flanders. A current saying among the peasants of Lombardy, we are told, is, " If the plough has an iron share the spade has a golden one." Spade industry prevails to a great extent in India ; it is curious to observe that with the peasant, be he in Europe or in Asia, the spade continues still to be, after all, the most favovrite handmaid.

A special character of Flemish agriculture is the extreme division of land. Flanders is *par excellence* the country of the so-called *petite culture*. The average size of farms in East Flanders is under seven acres, while it is said that 57 per cent. of the total number of farms do not exceed an acre and a half. The peasants are mostly farmers seldom proprietors, in this respect offering a great resemblance to the constitution of property in England. The real difference between England and Flanders arises from the relative extent of the *fermage*. I have said in a former report that the peasants of the south of France mostly own the lands they cultivate and so far do they differ from their Flemish brethern. The French law of succession, by which all property is equally divided among the children, obtains equally in France and Belgium, but it affects the agriculture of the two countries in quite different ways. In both a continual morselling of agricultural land has been going on ; but while in France it is the direct outcome of the law of succession by which the peasant's property, constituting his own farm, is immediately morselled out among his children, in Flanders the said division, on the contrary, is the outgrowth of an economical situation which has prompted the large landholders to let out land in small parcels at much higher rents. The division continues because the smaller the *exploitation* the larger the rent it fetches to its proprietor. Even where the peasant is the proprietor, the division of land is seldom carried beyond the point where the integrity of a field becomes involved. In such a case, the division cannot take place without the value of the land being diminished. It is then usual for one of the heirs to take up the farm and buy off the claims of the others. Thus the *morsellment* of land is very little affected by the law of inheritance, but is mainly guided by economic considerations. If the Flemish peasants know one thing better than another, it is that *intensive* culture is more lucrative than *extensive* culture ; and so do they prefer to lay out what little capital they may have in the *exploitation* of small farms, whence it results that the division of land has hitherto afforded very satisfactory results, at least from the point of view of rent and produce. It may be noted that the agricultural depression which is now weighing over the entire western Europe has checked for the time the further division of land. Farmers are not forthcoming to take fresh leases, rents are falling off, and the consequence is that land is gradually accumulating in the hands of large landholders, who are anxiously waiting for better times with a view to higher rentals.

B. C. BASU.

CULTIVATION OF TIL-SEED

Varieties]—From its general nature and color til is divided into four varities, viz, (1) black, (2) white, (3) kartiki or that which ripens in Kartik (October) and (4) weody. Besides these there are other unimportant varieties which are usually classed among one or other of the above four.

(1) *Black*]—Seeds of this variety are of a deep dark color and hence the name. The best time for sowing the seed is the latter end of July but as late as August it can be sown. This is the time however when the better class of lands is occupied with *aus* or kharif rice. Hence fallow or grassy lands are broken up with the plough and seeds sown on them. Curiously enough the crop succeeds better on the latter class of lands than on the former.

Late til however is sometimes sown in fields from which *aus* or kharif rice has been harvested early in August. In this class of land, the crop is more liable to disease and not unoften fails to flower. Care must be taken that the land on which til is grown be perfectly drained, as stagnant water is quite fatal to the crop. Hence it is necessary that the til-fields should be slightly raised in the middle falling very gently on both sides.

Soil.]—The kind of soil does not make much difference for the growth of it; only in calcareous clays and saline soils it does not thrive well. On soils of forsaken homesteads, it grows very luxuriantly and is lodged, or fails to bear flowers and fruits.

Tillage.]—It has already been mentioned that for growing til, the land should be thoroughly well-drained, and so disposed that rain-water must not stagnate. With the setting in of the rains, the fallow land is first ploughed and then allowed to rest. It is not necessary to follow the plough with the harrow the first time the land is ploughed, but every other time, the land is harrowed twice after each ploughing, the first harrow going in the direction of the plough and the second across it. This is supposed to break the clods better and rake up the weeds more efficiently. In ploughing also, the furrows raised by the first plough are crossed by the second. In this way the land is ploughed and harrowed at intervals of four or five days, till it is in condition to receive seeds. Loamy soils generally take eight ploughings and clay soil ten, before they are fit for sowing. The quantity of seeds necessary for sowing a bigha (⅓ acre) is 10 chhitaks. After seeding, the land is harrowed twice over, once in the direction of the last ploughing and once across it. The seeds must not be ploughed in, for in that case the seeds get buried too deep. The experienced cultivators sow the necessary quantity of seed in two lots, one-half each time.

After Cultivation.]—When the seeds germinate, the young plants should come out in clusters like those of rice, but if they come out too thick, they are thinned, as otherwise the crop does not succeed well. Seeds should not be sown even when there is a very gentle breeze blowing, because they are so light that they are easily blown away by the wind and thus accumulate in one part of the field, leaving the rest very partially seeded. When the seeding becomes partial, the germination necessarily becomes very uneven. If it rains the day next after sowing, the seeds as a rule do not germinate and those that do germinate seldom grow to be vigorous plants. Hence the cultivators particularly watch the motion of the clouds and the direction of the winds, before they risk their seeds on the land. After seeding, three sunny days are favourable for germination. When the young plants have sprung up, a few light showers now and again are very beneficial to them. If however the land gets beaten down by a heavy shower, the rake or hoe is very freely used, but care should be taken that the crop is neither too young nor too grown up. It is not particularly necessary, to keep the land clean by weeding.

Harvesting, etc.]—The black-seeded variety ripens by the middle or latter end of December, when it is cut, carted home, stacked on the barn-yard and thacthed with straw, or green grass. The stack gets heated and fermented within a fortnight, the leaves look flabby and rotten, from which the experienced cultivators make out that the stack is ripe for opening. The stack is then opened up and the fermented mass of crop spread over the threshing floor carefully prepared beforehand to dry. Within five or six days, the plants get dry and the pods break open at their top. They are then beaten with a heavy stick by which means the seeds come out of the pods. This process of drying and beating is repeated a number of times and before the straw is finally removed, it is trodden down by bullocks; this last treading separates away all the seeds from the straw which might have escaped the process of beating.

There is some risk in threshing the crop from the beginning by treading down with bullocks, as by this means the pods break away from the plants before the seeds are out, and it becomes very difficult to separate the seeds from the pods. Besides, the seeds thus separated are difficult to clean. This explains the practice of beating first and for a number of times, before giving the final treading. After harvesting, it takes about a month to prepare the seeds for the market. Hence the common saying goes "dinner after harvesting rice, but fasting after harvesting til."

(2) *White Seeded Variety.*] The seeds of this variety are milk white in appearance, but in

other respects they are very similar to the black seeded variety.

The only difference is that the sowing of this variety is finished within July and the crop ripens by the end of November or beginning of December. The crop should be harvested as soon as it ripens, otherwise the pods burst and the seeds come out. Stacking is not necessary with this variety, the crop is at once dried in the sun and the seeds beaten out as usual.

(3) Kartiki Til.] The seeds of this variety are both white and black. Very often the same plant bears both kinds of seeds. It ripens by the end of Kartik (November) and hence the name. In other respects, it is similar to the white seeded variety. The white and the Kartiki seeds yield more oil and hence sell four to six annas (per maund) higher than the black seeds.

(4) Woody Variety.] The color of the seeds of this variety is between the white and the black. The sowing of this variety is finished by the middle of February and the crop ripens by the end of June or beginning of July. It flourishes best, and is sown generally on *amun or winter rice* lands. It delights on calcareous clay and rocky soils. It is often necessary to irrigate the land during sowing time and, if the season happens to be dry, irrigation has to be continued at intervals. In other respects it is very like the black seeded variety, but the oil it yields is slightly inferior being slightly sticky and the smell not well-liked.

Diseases.] The greatest enemy of til is an insect which goes by the name of *ancha*, which looks very much like the larvæ of butterfly. It attacks the plants when they are just thriving and eats up the leaves and the young buds. To prevent the attack, the cultivators resort to various practices. They preserve carefully in a solitary place out of reach of the inmates of the house the new earthen pot (hanri) from which seeds are sown during seeding time and allow no one to defile it by touch. When the attack becomes visible, they collect a few of the insects and placing them in the said earthen pot fry them over a fire. The fried insects are thrown away at a distance. Some again take leaves of the banyan tree, trace twenty-eight marks on them and writing on them with lac dye the potent slokas bury them in the four corners and middle of their til fields. Others again read the potent slokas over a handfull of white mustard or rye and scatter them over the field. However, the means to prevent this disease is very simple. While the larvæ come out of the eggs, they are generally seen to swarm on a few leaves, and this is the time when the cultivators should be careful to destroy them. They generally take an earthen pot filled with burning dung-coke and, plucking the leaves in which the larvæ swarm, throw them bodily into the fire. With one man, it takes about three to four days to clear the larvæ from one bigha of crop. If this opportune time is allowed to pass by, they spread themselves all over the field and no men can then prevent them destroying the whole crop And the worse of it is that if one plot is attacked with this insect, all the neighbouring fields are doomed for that year.

Balance sheet for one bigha of land.

Liabilities.		Rs	As.	P.
10 ploughings ...	...	1	14	0
3 laborers extra .	...	0	7	6
Seeds 10 chhitaks	...	0	1	0
Harvesting, 4 men		0	10	0
Carting home		0	2	6
Treading, 5 men		0	12	6
Rent, say		1	0	0
	Total ...	4	15	6
Assets.				
2½ maunds of seed				
@ Rs. 3 per maund ...	...	7	8	0
Net Profit ...	... ...	2	9	6

It must be remembered that the cost of cultivation and the rate of rent are two items of expense which are very variable. The above holds good of a particular place in Assam and the balance sheet ought to be greatly modified for other localities. If one can raise 4 maunds of til from one bigha, he can earn as much as Rs. 7 per bigha, and as a cultivator can usually cultivate 5 bighas of til with one set of bullocks and plough, he can earn as much as Rs. 35 from his til during the whole year.

CULTIVATION OF TURMERIC.

Turmeric flourishes best on lands which have been lying fallow for a long time, or wood-lands which have been recently reclaimed.

Varieties.] — Turmeric is of various kinds, the varieties generally grown in Central Bengal are

pankal, *ada-gant*, *baga*, *sanchi*, and *kachu-mukhi*. Of these, the cultivation of the first two varieties is most common and paying. The rhizomes or so called roots of the other varieties look very plump when first taken out of the ground but on drying shrivel up almost to nothing. The first two varieties are very prolific, as much as 5 seers of rhizome have been sometimes gathered from one plant. The rhizomes are not very plump but on drying they do not shrivel up much.

Cultivation.]—The lands destined to receive cuttings of turmeric are generally completely turned our with a spade during November and December, and with the first shower of rain in March or April, ploughing begins. The land is ploughed and cross ploughed about eight times and harrowed 4 times so that the soil is well pulverized and the surface rendered level. When the surface is slightly baked in the sun, lines are traced on it by means of a plough at intervals of a foot and a half, and the seed-turmeric placed by hand on the lines alternately, that is, leaving one line unplanted between every two lines planted. In the lines, they are planted at intervals of 5 or 6 inches. After planting, they are immediately covered up by the hand with 3 or 4 inches of earth taken out of the unplanted furrow. Special care should be taken that the seeds are not exposed to the sun during planting. The field should be well hedged in to prevent cattle trespassing. In a month or so the plants grow to the height of about 5 to 6 inches, when they are ridged up by the spade. The cultivation finishes with this. The only care which it will now be necessary to take will be to see that rain water does not stagnate in the field. After every fall of rain, an inspection of the field is necessary, so that any obstruction to the free draining of water may be at once removed, otherwise the roots run the risk of rotting away.

Harvesting]—By the end of February or beginning of March, the plants wither up, when the cultivators cut away the plants down to the ridge and heap them up in a corner of the field. By means of a spade, they then dig out the roots and clean them. After which they bring them home and dry in the sun. But before they are dried, they are soaked in a mixture of boiling water and dung. After draining, the roots are spread on a yard to dry in the sun, and when they shrivel up a little, a man sits on a mat spread in the sun and rubs the roots on the mat. By this means the roots are cleared of all scales or root leaves which generally remain attached to them. When the drying is finished, it is tested by breaking a few of them. They must break with a clean break and sharp sound. They are either sold at once or stored up for selling at a convenient market price. In the latter case, the roots must now and again be exposed to the sun, to prevent insect attack. Turmeric dealers very frequently sprinkle on the heap of roots, water in which powdered turmeric has been mixed. This improves the color and look of the roots.

Out-turn]—With every thing favourable, the out-turn is sometimes as high as 20 maunds per bigha. But generally speaking, the out-turn may be taken at 15 to 16 maunds.

RURUL ECONOMY OF SHAHABAD.

[From the Diary of an Agriculturist.]

NASRIGUNJ (CONTINUED.)

RICE

It was not grown here before canal water became available.

Varieties.]—Of *Bhadai.*—Sirha and Sathe and of *Kharif*—Karhoni, Kariuga, Silhet, Barati, Kolbash, Batasha, Gopsar, Jarhan, Sanjira, Thakurbhog, Laldia, and Baitarni are the principal varieties.

Soil]—Where water is available Bhadai can be grown on any soil, but it does not do well on sandy soils. Kharif grows best on *karil*, but is also generally grown on Dorus.

Tillage.]—Bhadai rice is grown after peas or lentils. The land is ploughed just after the commencement of rains. After two ploughings the borders of the field are raised and water collects in it. The field is then ploughed and henga applied. About ½ maund of rice is sown broadcast per bigha. The field is once weeded. Constant irrigation is necessary, so the common saying goes.—

" Dhan, pan, nitya asnan", that is, rice and betel plants should be bathed very often.

Harvesting.]—It is harvested in Kuar (October.) Reaped by sickles and kept in a heap for 3 or 4 days. It is threshed by being trodden by the feet of the bullock. The straw is removed by the hands by shaking and the chaff is removed by winnowing with swoop.

For Kharif a good piece of land is ploughed, manured and then ploughed a number of times. The henga is then applied and seeds sown broad cast at the rate of one maund per kattah or one-twentieth of a bigha. The seeds are sown after water has been collected as in the case of Bhadai rice. After 3 days water

is removed. A man watches the land to prevent the seeds being eaten off by birds. The plants take 3 or 4 days more to come out. The field is irrigated a second time and weeded, which if the land has been well prepared is not necessary. This is the preparation of the nursery or seed-bed. The field in which the crop is to grow permanently is planted by the beginning of July. After 4 or 5 ploughings collect water in the field, plough, apply the henga and, in the mud, transplant the seedlings from the nursery in August. Seed required is one maund to 1½ maunds per bigha. In one hole they put 20-25 plants. After 3 days the water is removed; 3 days after the field is again irrigated. This is continued for about a month and half. By the beginning of September remove all the water and dry the land till the field become dusty. Then irrigate again as before till harvest time. The crop is reaped by the sickle and stooked in the fields till quite dry. Then it is either thrashed at once or kept in a heap as long as desired. Harvest time is November and December.

PEAS.

Varieties.] Only one variety—the grey coloured is grown here.

Soil.] Karil is best, next to that is Dorus.

Rotation.] After other Bhadai, after sugar-cane, or after *Chaumas*.

It is sometimes sown with wheat, barley, etc. If sown after any Bhadai crop, immediately the Bhadai is off the field, it is ploughed and after 4 or 5 ploughings henga is applied and sown by tar. In one bigha 1 maund.

After about 3 weeks irrigate once. It is reaped in March.

LENTILS.

Only one variety is grown.

SOIL.] *Karil* or clay soil is best. Next is Dorus

Rotation.] After Sirha or *Chaumas*, that is, 4-months' fallow.

Tillage.] When sown after Sirha, as soon as this latter is reaped plough the land 3 or 4 times. Apply the henga and sow by tar. Or sow broad-cast and then apply the henga. ½ maund is the seeding per bigha. It requires no weeding and no irrigation.

It is reaped in Chait by pulling or by the sickle, dried in the yard and threshed out by bullocks.

If after a fallow begin to plough in June and plough as often as the land is dry enough for ploughing.

Sown in Kartic.
Reaped in Chait.

Diseases.] When it is cloudy or when the east winds are blowing it is attacked by insects.

RAHAR.

Varieties.] Two varieties, one reaped in Magh and hence called Maghi, the other reaped in the Chaitra and known by the name of Chaiti, are generally cultivated.

Soil.] Bangar Balna is good for both varieties of Rahar. It requires a light and dry soil.

Rotation.] Best rotation is after the 4 months' fallow. Next to that is after peas.

Plough the land in June. After two or three ploughings both the varieties of Rarhar are sown broadcast at the rate of 5 seers per bigha. This is when sown alone as well as when sown mixed. Rahar is better when sown mixed with maize or *Sama*. Rahar is sown broadcats, then immediately after one man ploughs the land and another man puts the grain of maize in the open furrow,—one seed at a place and 18 inches apart. In the village of Khar 15 miles from Nasrigunj, Rahar is never sown with maize but always with Kodo. Apply the henga after maize has been sown.

Weed when the plants are 1 ft high; then when about 16 inches high plough the land. It requires no irrigation as it is sown in the rainy season but if there be no rains for sometime it may require irrigation once and sometimes even twice. Maize is reaped in the beginning of Kaur. It is reaped by the sickle—the cobs are taken off, the spathe is removed and the grains are beaten off.

Rahar is reaped by the sickle either in Magh (February) or Chaitra (March) according as the variety sown is Maghi or Chaiti.

Diseases.] It is attacked by insects when the east wind blows or the sky is cloudy. If there is excess of water in the field, the plants cease to grow or are all burnt up. It seems to be very sensitive as regards water and hence does better in well drained highland.

BARLEY.

One variety is grown here

Soil.] Light sandy soil is best suited to Barley. Very good barley is grown on patches of sandy loam in the bed of the Sone.

Tillage.]—Sown after Choumas or the four months' fallow; prepare the land as in case of wheat but give more ploughings to obtain a good tilth.

In the month of October, 1 maund per bigha is sown by the tar. No weeding is necessary. 2 or 3 irrigations are necessary. It is reaped in March.

Diseases.]—Bunt.

KUSUM.

Varieties]—Two varieties are grown, the Bhourly or Shaved and the Thorny. The flowers of the first are made into a dying stuff. The seeds of the second variety contain more oil but its flowers are not good and no use is made of them.

Soil.]—It may be grown in all soils, generally grown in sandy soils.

Rotation.]—Sown mixed with barley, wheat, peas or cicer. Therefore the land is prepared as for wheat, etc, which are considered the principal crops, the Kusum sown with them is considered of secondary importance. Some sow Kusum mixed with peas. In wheat or barley fields, it is sown on the borders or in rows inside at the rate of 3 or 4 seers per bigha.

The crop flowers in February. Flowers are picked up, squeezed with water, left two days on castor oil leaves, separated in the night time and then dried in the sun.

Seeds ripen in March. First, barley, wheat or peas as the case may be is reaped and then after about a fortnight the Kusum is ready for harvesting.

CORRESPONDENCE.

SIR.

As far as I believe there is no book authority for sowing rice with cotton, but from my own experience and from inquiries made through many experienced practical cultivators, I find it advisable to sow rice with cotton in virgin besar (mixture of black and gorat) soil. If we do not sow rice with cotton in such a soil, cotton grows very high at the expense of flowers, as also pods do not burst satisfactorily. Undoubtedly rice crop exhausts the fertility of the soil to a great extent, it will be really bad to sow rice with cotton in black soil. As for rotation crops I am of opinion that kharif crops of toor and til with rice will bring back its fertility, but these two crops are not advisable to sow with cotton; sometimes the poor ryots do so for their livelihood by leaving ample space between the rows of cotton. There is not the least doubt to believe that tall and leafy crops would give too much shade, thus the cotton crop has not the advantage of exposure. When we harvest rice which is generally the time in the middle of November, cotton is in its infancy, thus the cotton crop gets more than full two months for its growth which is, I believe, a sufficient time to attain maturity, hence no damage is done to the cotton crop in comparison to the yield of ricecrop.

As for linseed I beg to state that it is a rabi crop,—it is therefore impossible to sow it with cotton, the kharif crop, but it will serve better as a rotation crop. *

Rustampore, *Bombay.* } Bamanji A. Dalal

NEWS.

THE UNITED PROVINCES

The report for February 1886 on the prospects of the wheat and oil-seed crops is as follows:—There was little or no rain during February, but the heavy shower of December and January kept the land seasonably moist. Irrigation has, therefore, been much less resorted to than usual, and its expense has been saved to the people. Injuries from blight and fungoid disease were very rare. High winds however prevailed for a considerable period during the month, and to some extent caused a shrinkage in the weight and plumpness of both the wheat and seeds—particularly in Cawnpore, the Agra Division, and the southern portion of the Meerut Division. 100 is taken to denote a full average crop, and the prospects are given below in parts of 100, the figures being based on estimates received from zamindars and on the results of inspections made during February by the Agricultural Department of the North Western Provinces and Oudh—

			Wheat.	Oil-seeds.
Meerut	Division	...	86	75
Rohilkhand	„	...	92	84
Agra	„	...	75	75
Allahabad	„	...	80	84
Benares	„	...	85	92
Tarai	District	...	95	92
Lucknow	Division	...	100	90
Sitapur	„	...	95	85
Fyzabad	„	...	92	95
Rae Bareli	„	...	95	97

There is just a danger that the windy weather of March may have further shrunk the grain and reduced its weight.

THE PUNJAB.

The following is the report on the prospects of the wheat crop corrected up to the end of February 1886:—" The accompanying statement gives an estimate of the area under wheat corrected up to the end of January 1886. The area has very much increased, and amounts now to 67 lakhs of acres, or 7 lakhs more than the estimate of November. The

* In Assam it is a very common practice to grow cotton with rice on lands newls reclaimed from jungles.

increase has taken place on all soils, but more specially on unirrigated lands which had lost their moisture in October but were sown after the rains of December and January. There were complaints of want of rain at the end of February, but the good rain of this month has probably been universal, and the prospects of the wheat crop now are, almost without exception, exceedingly good. Even the late sowings are expected to give a fair out-turn."

Bombay

Wheat forecast, March 1886. In amplification of the telegraphic summaries given since December, an attempt is herein made to compile all available information regarding the area and condition of the wheat crop. The figures for the area are fairly complete, though, as regards Native States, the figures are less accurate than elsewhere. An attempt has also been made to compute the out-turn in tons for all British districts except Sind by the use of the formulæ, prepared under the orders of Government in 1883 for estimating out-turn. These formulæ, though not tested by sufficient actual experiment, are the best evidence available as to out-turn. It remains to be seen whether the estimate framed on them will stand the test of trade returns. No formulæ have been prepared for Sind or for Native States. For Native States the out-turn may be estimated according to the proportion found in the British Districts, thus:—

	British Districts. Tons.	Native States. Tons.	Total Tons.
Gujarat ...	130,200	158,400	288,600
Deccan ...	313,000	7,000	320,000
Karnatik ...	98,000	20,800	118,800
Total ...	541,200	186,200	727,400

Indian Wheat Crop of the Season 1885-86.

Since the publication of the first memorandum on the prospects of the current wheat harvest, further reports have been received from the Provincial Governments, from which the following particulars regarding the condition and prospects of the crop are taken. In the Punjab, prospects have decidedly improved and the season promises generally very favourable. Late sowings were made after the rains in December and January and the rain which has fallen in March has also been most beneficial. The area of the sowings is now estimated at 6,700,000 acres. In the North-Western Provinces and Oudh, the December and January rains were beneficial to the wheat crop, the subsequent period has been favourable and if this state of things continues, a very plentiful harvest may be anticipated in all parts. Some rust showed itself in the wheat in places in consequence of the cloudy weather and damp easterly winds, but it was slight, the crop was too young to suffer much from it, and the rains that followed washed it away. Taking 100 to denote a full average crop, the condition of the wheat in the United Provinces varies from 92 in the Meerut, Agra, Allahabad, Benares and Jhansi Divisions to 105 in the Rae Bareli Division.

In the Central Provinces prospects have deteriorated owing to the continuous cloudy weathers which has resulted in a good deal of rust. In no district from which returns have been received is more than an average out-turn anticipated and for the Southern districts the estimates range between 9 and 13 annas. Exports continue to decline and are less by 16,070 tons than they were last year. Prices are, however, generally lower than at the date of the last report. In the Bombay Presidency a certain amount of rust has occurred nearly everywhere, but it has done no great injury. Prospects are good and the crop promises to be a full average one. A three-quarter crop is the best expected in Gujrat, the Deccan, and Karnatic and in many places the yield will be much smaller. In the Southern Mahratta Country the crop is expected to be above the average. In Berar the wheat harvest has been almost completed. The area under crop is quite up to the average, being 808,514 acres, and the yield is generally from 12 to 14 annas. The total out-turn of the crop is estimated at 120,000 tons. In Central India and Rajputana, the wheat crop continues to promise well. The condition of other food-grains and non-edible crops continues satisfactory. The supposed normal wheat area of each Province is appended:—

	Acres.
Punjab	7,000,000
North-Western Provinces and Oudh	5,600,002
Central Provinces	4,000,000
Bombay	1,600,000
Berar	700,000
Rajputana	2,500 000
Central India	2,500 000
Bengal (Behar)...	850,000
Hyderabad	750,000
Kashmir	500,000
Baroda	88 000
Mysore	20,000

Veterinary Surgeon Mills, of the Madras Presidency, has been doing useful work in experimenting with Pasteur's anthrax vaccine. One hundred and nine Government animals and nineteen head of cattle belonging to ryots have been inoculated with vaccine from Paris during the past two years with very satisfactory results. During the preliminary experiments to test the strength of the vaccine after its voyage out, everything went well so long as the doses laid down by Pasteur were adhered to, but an over-inoculated guinea-pig died with all the symptoms of well developed anthrax. Having in view the success of Mr Mill's experiments, and the frequency and distinctiveness of anthrax outbreaks in India and the hopelessness of dealing with the disease when once established, it would be criminal on the part of Government not to provide against all contingencies by insisting on the inoculation of all army horses and instituting a staff of vaccinators for district cattle work. Of course the reluctance of the people to accept any

innovation, however beneficial will have to be overcome, and in this case, this will be unusually difficult because the process of inoculation by syringe and lymph resembles the common method of cattle-poisoning. If, however, Government want encouragement and a large field for vaccination operations, every indigo factory in Tirhoot and Chumparun with its large number of cattle is open to it and would certainly welcome anything that would afford immunity from disease. In this way prejudice would soon be over-come, rumour would carry the beneficial effect of the system far and wide and gradually the cattle vaccinator would be as welcome in every Indian village as the policeman is unpopular.

FRANCE.

The first bulletin for the present year has reached us from the French Ministry of Agriculture. The most interesting portion of the contents is an account of the budget of the Ministry for 1886, which amounts to 42 250,323f., or £1,690,013. This is not quite 779,000f., in excess of the sum voted for 1885. The main divisions of the expenditure are 23,686,470f., for the general service of agriculture, 16,184,203f. for forestry, and 2,379,650f. for special relief in cases of agricultural catastrophe and distress. Out of the first of these three sums, the various expenses of the State horse-breeding establishments, and money devoted to the improvement of horse breeding generally, amount to more than 8,000,000f.; while irrigation, drainage, and some other agricultural improvements absorb over 3,400,000f. The other principal items are these:— Surveys and works for water supply, 2,850 000f.; measures for the destruction of the phylloxera and other parasites, 2 000,000f.; agricultural education, about 1,720,000f.; veterinary education, about 1,000 000f.; subventions to various agricultural institutions, 817,400f; various works in Algeria, 954,000f.; prevention of contagious disease among animals and compensation for slaughter, 678,580f.; guarantees for great enterprises for the improvement of agriculture, 645,250f.; and the salaries of the Minister and the Central Staff of the Department, 630 300f. There is also among the articles on foreign countries one which should be read by those who are taking the lead in the movement for fixing labourers to the land. This is a long report on the migration of the rural population of Germany to the towns.

Customs Commission received a deputation from the society of French Agriculturists, who insisted that the duty on wheat ought to be 7f., with one of 8f. on oats, rye and buckwheat. On foreign cattle, also, they considered an augmented duty imperative. The other side of the see-saw was represented by M. Moulin, delegate from the Marseilles Chamber of Commerce. This gentleman clamoured for the repeal of the law of 1885, that is the 3f. duty on wheat.

It is generally stated that no evil effects of the late frost are perceptible among the young wheats, but in the eastern departments artificial grasses have suffered severely and the vine is to some extent injured.

Dr. Menudice has just presented to the superior Phylloxera Committee his annual report on the competition for the £12,000 prize which is for ever dangled before the eyes of all who aspire to invent a perfect remedy. No fewer than 161 persons have this year climbed the greased pole, some of their watchwords are amusing; some have caused ill effects. Try artificial earthquakes, say one competitor; vaccinate the vine, cries another competitor; use arsenic, shouts another, and one cultivator dies from imprudent conduct in using the poison. Let us hear the end of the whole matter. "The prize of £12,000, created by the law of 1874 for the invention of the most effectual means of combatting the phylloxera, is reserved; the means to be employed in 1886 are (1) submersion, (2) sulphide of carbon, (3) sulpho-carbonate of potassium"

The report of the year's work at the agricultural school of Montal (Lot) shows a net profit at £416 upon the 180 acres cultivated. The wheat grown on 50 acres averaged nearly seven quarters per acre. The students are turning out well, all the old alumni adhering to the agricultural pursuits.

The show season opens at Narbon on the 8th proximo, when a very wide variety of implements will be on the stands. Issoudun follows with a sheep show on the 24th. The show and congress of the National Horticultural Society are to take place, the former from May 11 to 16, the latter from the 13th to the 15th May.

A Bill is before the Chambers to prevent the sale and exportation of oleomargarine under the name of butter, and has been referred to the committee which has M. Melines' Bill in hand upon frauds in the butter trade.

GERMANY.

The quantity of animals slaughtered at the Central Cattle Yard during the month of February last has greatly exceeded that slaughtered during the corresponding month in 1885. Last year 49,690 animals were killed, this year the number was 52,926. More pigs were slaughtered this year, the number being 1,339 head, 751 head of oxen and 1,223 sheep; in calves there was a decrease of 77 in number. It is worthy of notice that of 24,750 pigs that were slaughtered only five were tainted with trichinosis and three with aktimyces, whereas 287 were rejected because they were measly, and 42 on account of other diseases. In all 36 oxen, 4 calves, 5 sheep, and 360 pigs, were rejected as being unfit for human food.

It has lately been computed that during the year 1885, 110,028 persons have emigrated from Germany. Out of this number, 88,900 (62,006 from the Prussian States and 26,894 from the other German States) left their homes by German ports, the rest went by Antwerp, Amsterdam, and Havre. In comparison to the preceding year, the number of emigrants has decreased by 40,000 persons, and as compared with 1881 has decreased to one-half. The above particulars have been furnished by the Imperial Statistical Inquiry, which has gathered a great deal of useful information on the subject.

VICTORIA.

The Australasian of Feb. 6 says :—The change of weather which occurred last Saturday brought a considerable fall in temperature, with thunder-storms more or less heavy, extending over a very large area of country. In the potatoe districts about Portland second growth is being caused, and the cut hay crops have been damaged. Bridgwater-on-the-Loddon, which has long been dry, has received a heavy fall, permitting ploughing to be commenced. From some parts of the Wimmera and Goulburn, we hear complaints of the irregular condition of the bulks of wheat, owing to the damage done by rains during and after harvest, before the grain was properly secured. Buyers are now becoming cautious and particular, and which is only prudent, seeing that the credit of the colony may be jeopardised in European and also in colonial markets if damaged wheats are unwittingly forwarded as prime. From Talbot we hear of some yields of oats, a yield of 60 bushels an acre being obtained on a farm at M'Callum's Creek; barley on a farm near Carisbrook gave 50 bushels per acre, and short oats 50 bushels. Altogether, this is a season of extremes, and in some districts they are not far apart.

SOUTH AUSTRALIA.

The *Register* of the second week of February reports:—The harvest, such as it is, has now been gathered in, and the result a terrible disappointment to our farmers. It seems doubtful indeed, if the general average will reach three bushels per acre over the whole area that was sown for wheat and a very large surface has been mown for hay, the average cut of which probably gives little over 10 cwt. to the acre. The farmers, however, though driven to great straits by the almost complete failure of their crops, are not despondent, but are preparing the ground to sow every acre they can find seed wheat for. Only in some few cases is there any inclination to throw up the land. Throughout the country there seems to exist a profound conviction that the seasons are changing and that the coming winter will be early and wet.

The Agricultural College was reopened on Wednesday, February 3, and an opening address was delivered to the old and new students by Professor Custance. The *Adelaide Observer* understands that every bed in the College is occupied by practical and science students, and that there were several applications for admittance as working students, but owing to the want of accommodation they could not be received. As soon as the Government provide further sleeping room, a class of working students will be received.

PUNJAB.

Returns of the Punjab Rail-borne trade—The total imports of the selected articles shown in the returns for the quarter ending 31st December 1885, amounted to 1,306,831 maunds as against 976,696 maunds in the previous quarter. Exports were 7,99,183 maunds as against 5,99,183 in the previous quarter. Exports of wheat during the quarter under report amounted to no less than 6,120,780 maunds, of which about two-thirds was sent to Karachi, one-sixth to Sindh, and nearly one sixth to Bombay. Altogether close upon fourteen million maunds of wheat were expected from the Punjab between the 1st. April and the 31st. December 1885, of which all but two million maunds was booked to Sindh and Karachi. On the other hand, imports of sugar both drained and undrained and exports of gram and rape and mustard-seed have fallen off very considerably. Altogether only 2,648,934 maunds of rape and mustard-seed were exported between the 1st April and the 31st. December 1885. This shows a great falling off as compared with the year 1884-85. As compared with previous years, however, exports of oil seeds have increased.

ASSAM.

River-borne Trade of Assam.—The total value of the imports during the quarter ending 31st. December 1885, amounted to Rs. 68,96,881 and of the exports to Rs. 1,47,65,418. In these figures the value of treasure has, as usual, been omitted. There is a decrease on the returns of the corresponding quarter of the previous year amounting in the aggregate to 9 per cent. The decrease showed itself in both exports and imports, and occurred in Brahmaputra and Burma Valleys alike. The principal falling off was in the imports up the Mogua caused by a diminution in the supply of European cotton piece-goods, kerosine, and salt required by the inhabitants of Sylhet and Cachar. Compared with the corresponding quarter of 1884, the main staples of import which exhibited a quickening of trade were rice, pulses and liquors. The rest showed a falling off, except metals, in which the traffic remained almost stationary.

Of the articles exported from the Brahmaputra, Valley during the quarter under report, the most important were Tea. Timber, Mustard Tea-seed-Jute, raw, and Lac. Tea, as usual, was by far the most valuable. It was sent entirely by steamer to Calcutta. Tea-seed was exported by the same means and mainly to the same place (85 per cent.) Timber went down entirely by boat, and was consigned principally to the Chittagong division (60 per cent.) Calcutta absorbed almost the whole of the lac, 83 per cent of the mustard, and 76 per cent of the Jute. Steamers monopolised the greater part of the trade in these commodities. Compared with the trade of the corresponding quarter of the previous year, the exports of tea-seeds, paddy, and rubber show a considerable increase. Tea exhibits a slight falling off. In point of weight, lime and paddy form the bulk of the exports of the Surma Valley, but in point of value tea, as usual, stands first. Oranges begin to be plucked from the middle of October, and are exported in large numbers during the last two quarters of the year. The main staples exported during the period under review are given below:—Tea, Paddy, Lime, Oranges, Potatoes, and Hides. Compared with the corresponding quarter of 1884, there was an increase in the exports of lime paddy, ghi, dry fish, and linseed, but a falling off in all other main staples of trade.

EXTRACT.

EGGS AND HATCHING.

By Professor Long.

Since, as a very young amateur, I possessed my first hens, I have known persons who have insisted

that they can select eggs which if they hatch at all will produce cockerel or pullet chickens as the case may be; but in a long experience among poultry amateurs, I have never come across the individual able to successfully accomplish the feat, and yet to-day there is as much ignorance upon this one point as upon anything in connection with poultry breeding. As a general rule it is quite sufficient to put one question to those who claim to be able to do what is impossible, and this may be put with effect by any person who knows but little about poultry or the conduct of a poultry yard. The question is, "Is it possible to distinguish the cockerels from the pullets in a bach of, say, Brahma or Cochin chickens which are under a week old? As this cannot be done, it is scarcely possible that the new-laid egg will afford any clue to what is impossible of discovery in the live bird.

The generality of people do not understand the construction of an egg, to say nothing of the mystery of its vitality or that fertilising agent which distinguishes a good egg from a bad one after it has been sat upon by a hen. It is imagined by some that hens will not lay unless a male bird is in their company. This, of course, is a fallacy. Others object to eggs laid by hens in the company of a male bird because they contain a small bunch of mucilaginous substance, which they believe to be the fertilising agent, being ignorant of the fact that this is present in all eggs, of which it forms part. Its office is to properly suspend one portion within the other. The agent referred to has never yet, been discovered in the egg, and although the germ is known to exist within the centre of the yolk science has failed to show when it is fertile and when it is not. This fact bears most distinctly against the common assertion of country people that they can distinguish the egg which will produce a chicken from that which will not. If scientific examination of the very germ fails to do this, it is very difficult to understand how any individual, no matter how clever he may be, can perform so extraordinary a feat. All the doubt arising upon a point of this kind should be at an end, for both physiology and common sense absolutely disprove any such possibility. The egg is fertilised while the yolk still hangs upon the ovary. The ovary is, to speak plainly, a bunch of yolks from the size of a small pea upwards. These grow until they are normal in size and ripe for emission into the world. When ripe they fall off the bunch into the oviduct, when they are gradually enveloped in a glairy albuminous fluid, which we know as the white of the egg when it is cooked. As it rolls down the duct covered by layer after layer of the white, it is finally enveloped in the shell, and the work is completed by laying. The fertility of the egg is decided before the yolk leaves the ovary, hence it is impossible to understand how the subsequent shell-covering can in any degree whatever be connected either with the fertility or the sex.

Sometimes it happens when something abnormal occurs with the hen that a yolk is ripe for laying before a sufficient quantity of the albumen has been formed—before indeed, there is a single layer in the oviduct. In this case, the yolk in its passage through is either enveloped with a very small quantity, or is not covered at all until it is enclosed by the shell, which is appropriate in size to the diminutive dimensions of the egg. Again some-times nature supplies a large quantity of albumen *i. e.*, the white of the egg, before the yolk is ripe In this case the albumen is thrown off and similarly enveloped by a small shell. There are few persons who keep hens who have not at some time in their experience found an egg no larger than that of a bantam, or even of a pigeon, in one of the nests. Such eggs invariably contain the yolk or the white instead of the ordinary quantity of the two. This fact is one more physiological proof that the shell adapts itself to the requirements of the yolk and the white, and that it can, therefore, have no possible part in indicating either the sex of the chicken or the fertility of the egg. As a matter of fact, it will be found that long or pointed eggs are commonly laid either by pullets whose eggs are always of one shape, or by old fat hens whose condition is the cause of such a formation. Change the condition of the latter by reducing the fat—and the eggs will quickly resume their rounded shape. Of course, no one who at all understands the subject will be disposed to argue that a pullet which always lays long or pointed eggs will produce nothing but cockerel or pullet chickens, as the case may be, and yet there are scores of farmers who declare that a pointed egg will produce a cockerel.

I am inclined to believe that the question of sex in poultry is one in common with that understood by breeders of the larger kinds of farm stock. It is with some a disputed point as to whether cockerels are more largely produced by the mating of young, vigorous cockerels with old hens or vigorous old cocks with pullets. I am personally of opinion that a very large proportion of male birds come from the mating of strong pullets with old cocks, but this will not be borne out in ordinary practice, because pullets are generally late hatched, and either diminutive or lacking in vigour, while old cocks are of two kinds. If they are exhibition birds, they are seldom of value for breeding after their second year, and if they are farm-yard birds, they are

commonly as vigorous as young cockerels, hence the conditions of success for a trial of this kind are in a general way usually wanting.

There is another point respecting the shape of the egg which should not be forgotten, more especially at the present moment, when so many persons are using their eggs for hatching purpose. Where a number of hens are kept, some of the eggs will frequently be found with a coruscation or raised, uneven bend of the shell running round the centre. I have certainly hatched chickens from eggs of this description with success, but the defect or blemish is a very undersirable one,a large proportion of such eggs being infertile. Hens which lay them are invariably out of condition, and suffering from congestion or contraction of the oviduct. This has an effect upon the shape of the duct, and consequently upon that of the shell formed within it. As hens which are not healthy—and they are simply animals in this respect—seldom breed, it is not a very surprising fact that chickens in so many instances are not produced from their eggs.

There is one more feature worthy of remark. I refer to the size and position of the air-pace at the end of an egg, from which it is commonly supposed by some that the fertility of the egg can be ascertained. This is another mistaken idea, and one which should not for a moment be entertained. The air-space in question, however, is most important to the breeder who conducts his work rather upon modern than upon the old lines, for it enables him to tell very rapidly and very decisively at the end of a certain number of days whether the eggs he is using for hatching are fertile or not. The majority of poultry keepers are most unwilling to touch the eggs upon which a hen is sitting, until the end of the three weeks of incubation, although it often happens, especially in the early part of the breeding season, that all, or at any rate, invariably a large proportion, are "clear," *i. e.*, do not contain a chicken. Now at the end of six days the most perfect tyro can, by examining an egg which he shades by his hand in holding it before a candle or lamp, detect whether it is fertile or not. A dark line will appear at the base of the air-space, below this the egg will be dull and opaque, while, above it, it will be bright and light. Day by day the dulness increases until it becomes quite black and the line at the base of the space referred to sharper and clearer. As a rule the sharper this line is the more certain we may be as to the living contents of the egg; but if it be undefined and dull, the egg will be found addled or rotten. An infertile egg never changes, and when held before a light whether at the end of six, ten, or twenty days, will exactly resemble a new-laid egg except the air-space at the top will by the increase of air has become larger.—*The Mark Lane Express.*

CALCUTTA MARKET REPORT

Indigo.] The April Indigo auctions commenced in London on the 12th instant, and were concluded on the 15th with the following general results :—

Total	Bengals	sold	900	chests.
Do	Oudes	sold	100	do
Do	Kurpahs	sold	1,000	do
Do	Madras	sold	200	do
Do		sold	2,800	do
Do	withdrawn		4,300	do
Do	bought in		1,100	do

Bengals were generally		3*d.* to 6*d.* lower.
Oudes were generally		2*d.* to 3*d.* lower.
Kurpahs middling generally	par	to 2*d.* lower
Do ordinary		3*d.* to 4*d.* lower
Do low		3*d.* to 4*d.* lower.
Madras dry leaf	par	to 3*d.* lower.
Bimlipatam	par	to 8*d.* lower.

Shellac is declining daily, the last transaction in T N quality having been at Rs. 20 at which price there are still buyers. The only other sales reported were in Britton, which found buyers at unchanged rates.

Tea.]—During the week ending 4th instant, auctions were held in London in which 23,000 packages of Indian teas were offered and 17,700 sold. Common qualities were without any material change. During the second week, at London auctions 18,000 packages of Indian teas were offered and 15,200 sold. The medium to fine qualities were ½d. lower.

Public sales were held in London during the third week at which 15,000 chests of Indian Tea were offered and 12,800 disposed of. Common qualities were rather lower, and there was also a slight decline in medium descriptions.

Wheat.]—During the week ending 4th instant about 6,000 tons of club No 2 changed hands at about previous rates.

Quotations were as follows,-

Club No. 1...May-June delivery...Rs. 2-9-6
Club No. 2...April-May ...Rs. 2-8

During the second week a fair business was done. The sales amounted to about 3,500 tons of Club No. 2 at Rs. 2-7-9 but the market at the close was higher at Rs. 2-9-3.

The sales reported during the third week did not exceed 2,500 tons. Quotations were Rs. 2-9 for

Club No. 1 and Rs. 2-7-9 for Club No. 2, and the market closed very weak. During the fourth week transactions were restricted to about 1,000 tons. Quotations were Rs. 2-9-6 for Club No. 1 and Rs. 2-8 for Club No. 2, May delivery.

Linseed.]—During the week ending 4th instant, the sales aggregated to about 11,000 tons at price which showed little change.

Quotations were as follows.—

Small grain, 5 per cent refraction

April-May	Rs. 3-15-6
do 20 per cent. refractions	Rs. 3-11-0
do " " " "	Rs. 3-7-3

During the second week about 2,500 tons of small grain, 5 per cent refraction, were sold at Rs 3-15-6 to Rs 3-15. About 4,500 tons of small grain, 5 per cent. refraction, changed hands during the third week. Prices advanced half an anna, Rs. 4 being quoted for small grain, 5 per cent. refraction, April-May delivery. During the fourth week it changed hands to the extent of about 2,000 tons, and the market was firm especially for immediate delivery. Small grain, 5 per cent. refraction, was quoted at Rs. 4-0-6 for April-May delivery.

Jute.]—During the week ending 4th instant, Jute was extremely dull, quotations for ordinary marks were Rs 20 to Rs 21. Business in baled jute which was confined to a few small sales on the third week was chiefly for ready delivery at unchanged price. During the fourth week there was no improvement in the demand for baled Jute, and further business was rendered more difficult by an advance of about 2 annas per maund, which took place in the value of loose Jute. A sale of 1,000 bales new Dowrah, September-October delivery, was reported to have been made for the coast Rs. 16.

CROP AND WEATHER REPORT.

For the Week Ending 14th April 1886.

General Remarks.—During the past week there has been slight rain on the Malabar coast in Chittagong, in parts of the central districts of Bengal, in Meerut, Rawalpindi, Peshwar and Sialcot, while heavier falls have occurred in the eastern districts of Bengal in Assam.

The reaping of the rabi harvest is nearly over in Bengal the N.W. P. and Oudh, the C. P., Bombay and Rajputana, and threshing and winnowing are going on. In parts of the Punjab the harvest has commenced.

The standing crops in the Madras Presidency and Mysore are in good condition ; but rain would be beneficial in the Malabar district and in the coffee districts of Mysore.

The prospects of the boro rice crop in Bengal, are favorable except in two districts, where rain is needed. Preparations for the aus rice crop continue and jute sowings have commenced. Sugarcane is being planted, and the land is under preparation for the Kharif in several provinces. Cattle-disease is reported from Madras, Mysore, parts of Bombay and Sind, the N.W. P. and Oudh, the C. P., Burma, and Assam but is nowhere severe.

Prices of food grain are generally steady in Bengal and the markets in the N. W. P. and Oudh are well supplied. In the Punjab, prices are rising in Delhi and falling in the Peshwar districts ; elsewhere they are stationary. In the C. P. prices are fluctuating, with a tendency to fall and the wheat trade is reviving.

Small-pox and fever are reported from parts of the Madras and Bombay presidencies and of Rajputana. Cholera is prevalent in eastern Bengal and in some districts of Assam.

For the Week Ending 21st April 1886

General Remarks.—Rain has continued to fall during the past week in Assam, and there have also been showers in parts of the Madras Presidency, in Mysore, Koorg, and Hyderabad. With the exception of the Amritsar and Peshwar districts, no rain has fallen in Northern or Central India.

The weather is generally seasonable, westerly winds prevailed in Northern India, and the temperature is rising.

The Rabi harvest is in progress in the S. E. Punjab, and prospects are favourable. In Bombay and Sind it is nearly completed ; and threshing and winnowing operations well advanced in N W. P. and Oudh, Behar, the C. P. and C. I. Station. In the Meerut district the outturn of the wheat crop has been favourable than was anticipated.

Cotton is being picked in Surat and Dharwar and in the Madras Presidency, where rice and ragi are also harvested.

A good outturn is expected from the Boro rice crop in Koorg and the aus rice and indigo sowings are progressing, though rain is wanted in some districts. Some damage is reported to have been caused to the boro rice in Sylhet by the recent rain-fall.

Standing crops in the Madras Presidency and Mysore are generally in good condition, but are suffering in a few districts for want of water. Rain is also much needed in Mysore for coffee-planting.

The land is now being generally prepared for Kharif sowings which have increased in Sind. Sugar-cane is being pressed and planted in N. W. P. and Oudh and in Bengal, where planting has been nearly completed, the cuttings are progressing favourably.

Prices are generally stationary, except in Mysore and Coorg where they have fallen.

Cattle-disease is reported generally. There is some scarcity of water and fodder in Mysore and in parts of the Bombay Presidency and Rajputana.

The public health is generally good though fever and small-pox are reported from many places.

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Madras Agricultural College.—Since the College was opened, 113 students have gone through the course, and have been granted certificates—81 first class, and 32 second class. During the past year were granted more certificates than in any previous year. To afford some idea of the amount and varied character of the work that is demanded from students before they can get the College certificate, may be enumerated the subjects in each of which they must get 33 per cent. of the marks alloted, and 60 per cent. of the aggregate:—Agriculture in all its branches; Veterinary Science, including Anatomy, Physiology, Materia Medica, Therapeutics and Pathology; Chemistry, Inorganic and Organic, including Laboratory practice; Botany, including Horticulture; Physiography, Mechanics, Mensuration, Surveying, Plan-drawing, Estimating, Book-keeping, Arithmetic, Civil Account Code and Land Revenue Regulations. Though the subjects are very numerous, the course is a long one, and the work is so arranged that the demand made is not greater than can be met by fairly well-educated student who has studied up to the Matriculation standard, and who works steadily and is persevering. There is one excellent feature in the system of the College which is notice able. It is this:—no single examination, or set of examinations is accepted as decisive; a student, therefore, who is idle, but who has good abilities, *can not* by putting on a spurt just before the examinations are to be held, *cram up* sufficient *to pass him*, for the marks gained at every examination during the whole course are counted in determining the student's position. Steady regular work during the whole course is thus secured. They are employed, 33 as owners, superintendents or occupiers of estates and farms, agricultural lecturers, agricultural inspectors and land revenue inspectors; 14 are employed in the Forest Department of the Presidency and Native States; 21 are employed as Cattle Disease Inspectors and in private veterinary practice; 13 are employed as Editors of Journals, Museum Curators, schoolmasters and Collector's clerks; 5 are engaged as traders in oil, sugar, &c., while one has obtained the Diploma of the Royal Agricultural College, having gone to England and studied at the College at his own cost. At present in the Bombay Presidency there are 13, in the Mysore Province 7, in Bengal 1, and in Patna, Kattyawar, Gondal, Baroda, Dewas, Travancore and other States, one or two in each; and one or more in each district of the Presidency.

There are now 94 students, excluding the Cattle Disease probationers, who attend lectures. These students came from Bengal, Burmah, Bombay, Patiala, Rajputana, Coorg, Mysore and Travancore, while every district of this Presidency has one or more representatives. Of these students about 20 per cent. are Europeans, Eurasians, and Native Christians; 50 per cent. Brahmans; 6 per cent. Muhammadans; and the remainderr are Sudars, Bhudhists and others. As regards their educational attainments, 6 have passed the F. A. Examination, 60 the Matriculation Examination of the Madras, or other University; 23 have passed the Middle School Examination, and only 5 have not passed public examinations. And as regards their connection with the land, the family of one student hold upwards of 200,000 acres of Zemindari land

in Bengal. The families of two students hold each upwards of 4,000 acres of land of the Presidency. The family of one upwards of 3,000 acres; of one 500 acres; of one 400 acres; of one 300 acres; of one 200 acres; of 8 from 100 to 200 acres each; of 10 from 50 to 100 acres each; of 26 from 20 to 50 acres each; 15 from 10 to 20 acres each; 15 possess less than 10 acres each, and only 15 students in the College have no land. It will be seen, therefore, that the College is steadily becoming more closely connected with the land.

THE ROYAL AGRICULTURAL COLLEGE.—We are happy to announce two entrance scholarships, in consequence of a private benefaction to the College, of the value of £25 per annum each—tenable at the College by in-students only, for two years, subject to the conditions of admission and regulations for in-students. The candidates must be natives of Great Britain or Ireland, or of the Channel Islands; not less than seventeen, nor more than nineteen years of age, on the first day of the examinations; and satisfactory testimonials of diligence and good conduct for three full years next previous to their candidature from their schools or tutors must be presented. The subjects of examination are to be the four following.—*a*, Arithmetic and Mensuration; *b*, Elementary Geometry, as far as Euclid, Bk. III.; *c*, Elementary Algebra, as far as Quadratic Equations; *d*, Physical Geography. Regard will be had to handwriting and orthography. Names and addresses, certificates and testimonials, and the examination fee, of to be sent to the Principal by the parents or guardains. The successful candidate in either case will, if approved for admission, be required to enter for the session next following the examination.

* * *

The Spring term concluded on Wednesday, April 14th. Rev. J. B. Mc. Clellan, Principal, distributed the diplomas, &c., in the hall. The work of the term has been successful, as shown by the fact that in the recent examination by the Highland and Agricultural Society of Scotland, five of the diplomas of Fellowship and six of the ten first class certificates were gained by past and present students of the college.

Appended are the chief awards:—

Diploma.

(Maximum Marks, 2,100. Qualifying Marks, 1,400.)

Henry Hewetson McMinnies, Farington, Preston, Lancashire ...	1,753
Thomas Brigg, Kildwick Hall, Leeds, Yorkshire ...	1,581
Percy Stuart Dove, The Manor House, Nutbourne, Pulborough, Sussex ...	1,566
Basil Shillito Cave, Queensberry House, Richmond, Surrey ...	1,554
Mohammed Abdul Rasheed, Allahabad, India	1,512
Theophilus John Massie Metcalfe, Bengal, India ...	1,406

Ducie Gold Medal.

Henry Hewetson McMinnies.

Scholarships.

(Open to the whole College.)

(Qualifying Marks, 2,250. Maximum Marks, 2,700)

First and Second Scholarships:—£25 &.£10.

Alfred Dennis Faber, Ilfracombe, N. Devon	*æq.*	2,658
John William Pitt Muir-Mackenzie, 8, West Eaton Place, London	...	2,638
Nogendro Nath Banerjea, Bengal	...	2 621
Nitya Gopal Mukerji, Bengal	...	2,578

Third Scholarship:—£10.

Alexander Goddard, Beausite, Victoria Road, Leicester	*æq.*	2 572
Colin Campbell, Jura, by Greenock, Scotland		2,566

The following were honourably mentioned in order of merit (qualifying marks, 2,250):—Andrews, 2,531; Carrington, 2,441; Cheney, 2,436; Khasherao, 3,419; Nicholl, 2,372; Sri Lal, 2,360; Steedman, 2,319; Bayley, 2,305; Tucker, 2,292; Drieberg, 2,279; Horsley, 2,250.

* * *

STEAM PLOUGHING.—A Set of Fowler's Steam Ploughing machinery has recently been most successfully started on Captain Chapman's estate at Bati near Allahabad. It is on the double engine system, one engine at each end of the field and the implement hauled backwards and forwards by means of winding drum and steel wire rope. This system is now adopted in all parts of the world for opening up jungle lands, and as the engine can be applied for sawing, pumping or driving the machinery when the land is too wet to work, there is no doubt it can be successfully used in many parts of India. The set alluded to is now breaking up new land in a way acknowledged by those who have seen it, far more satisfactory than it would be possible to do with ordinary digging and the country plough. The cost inclusive of a European mechanic in charge at Rs. 300 per month, coal at Rs. 14 per ton and allowing 20 per cent. for interest on capital and depreciation of machinery, is only about Rs. 8 per English acre, and on estates where wood fuel is procurable this price can be reduced considerably. As the success of steam ploughing machinery depends greatly on having implements spe-

cially suitable to the land to be cultivated, Messrs. Fowler & Co. can undertake to visit any land intending purchasers may think of cultivating and advise as to plant necessary.

LAHORE VETERINARY COLLEGE.—At the distribution of prizes to the successful students at the Lahore Veterinary College the other day, Sir Charles Aitchison paid the Principal of the School a deservedly high compliment in dwelling on the satisfactory progress his scholars had made. In his speech Veterinary Surgeon Kettlewell pointed out how in the past four years the institution, from small beginnings had established itself on a broad and solid basis of practical usefulness. Improved systems of teachings and training the students were, the speaker said, now in progress and in proportion to the increase of practice, the theoretical instruction, which was unavoidable at the beginning, was gradually giving place to practical teaching on all points. The standard of educational requirements has been steadily raised; and there was noticeable a marked improvement in the veterinary work of the pupils who had passed out of the Hospital. *Viva voce* questions had been substituted for written ones in the recent examinations—a change which Mr. Kettlewell thought was distinctly for the better. Sixty-two candidates had passed out of the school since its formation in 1882; and, so far, satisfactory reports had been received about them all.

A NEW SOWING MACHINE.—A novelty in agricultural implements has just been patented in the United States. This is Spitler's combined harrow and replanter, the construction of which is such that when the harrow is being drawn along to kill weeds and loosen the soil, and a place is reached where the seed has not germinated, seed can be at once dropped in the place for filing up the gap. The necessary apparatus for this latter purpose is carried above the ground when not in use, and can be lowered and the seed dropped into the ground while the machine is in motion. The patentee is Mr David A. Spitler, of Flora, Ind.

TOBACCO IN ENGLAND.—Tobacco could be profitably and successfully grown in very limited districts of Belgium and the Netherlands, where the soil was suitable and the climate sufficiently mild to promote its growth and alienate all bad influences. The usual practice in both countries was to sow the tobacco seed in hot-beds, which ought to be ready not later than the 1st of April. The soil for the tobacco plant should be a rich loam, heavily manured with farm-yard manure in the autumn, and again with sheep-dung and rape-cake, as these appeared to be the most suitable manures. It was necessary that no less than five tons of tobacco be available for curing at one time, and this would probably account for the fact that where tobacco was grown on small farms, they were always round and about a tobacco-curing place. The operation called "sweating" of tobacco could not be induced unless there was a sufficiant amount of material to deal with. It would be, therefore, useless to make the experiments except on a large scale, and this would involve a considerable expenditure of money. It was an extremely problematical question as to whether the growth of tobacco could be profitably carried out in England.

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AGRICULTURE IN VICTORIA.—Irrigation occupies a prominent place in the programme of the Ministry in Victoria, and a somewhat extensive project is foreshadowed. From the inquiries instituted, it is stated that certain of the rivers are capable of supplying sufficient surplus water to irrigate several million acres, that sites for reservoirs are available, that the cost of construction and distribution is "within the means which can be reasonably provided by the State in the first instance," and that the works for the purpose will be carried out under the control of the State and of those most vitally interested in their success. It may be inferred also, from what is said about the outlay not exceeding "the amounts which may be profitably invested in them," that they are intended to be—except under very special circumstances—of a reproductive character. The interests of agriculture are also to be consulted by the establishment of a college and schools, in which husbandry will be taught both in theory and practice, and it is promised that information shall be collected—by methods at present undefined—from all parts of the world in relation to improved machinery, new processes, diversified crops, and other matters upon which it is necessary the farmers should be as well posted up as those of any other country in the world.

MESSRS WILLIAM MORAN AND CO'S. MARKET REPORT OF 22ND MAY. There have been several falls of rain all over the various indigo districts, and prospects generally have improved. In Behar the falls of rain have been sufficient in most cases to enable planters to fill up any lands that were still empty, or where the sowings had failed, and general reports on the standing crop are good, although there are a few complaints of blight and caterpillars. At present it looks as though *mahai* would be earlier than usual. In Lower Bengal generally the rain fall

was heavier than in Behar. The October plant has improved very much, but it is doubtful whether spring sowings effected so late in the season will come to much good. From the Benares provinces we have many complaints of blight and insects, but it is to be hoped that the late rain will improve matters. From the North-West we have no advice of interest, nor have we been able as yet to ascertain how the area of native cultivation compares with that of last season.

INDIGO IN THE UNITED PROVINCES.—Statement showing area and amount of indigo during 1885.

District.		Number of factories which worked during the year 1885	Number of hands employed during the year 1885.	Amount of indigo produced in 1885.	Area under indigo in 1885.
Saharanpur	...	2	56	11	1,141
Muzaffarnagar	...	7	216	80	3,970
Meerut	...	72	3,296	1,211	20,050
Bulandshahr	...	130	5,496	1,946	51,761
Aligarh	...	148	7,488	2,710	46,722
Moradabad	...	6	120	26	353
Bareilly	...	32	872	247	2,739
Budaun	...	73	2,224	628	8,8 0
Shahjahanpur	...	28	584	109	2,731
Pilibhit	...	8	192	47	1,197
Muttra	...	53	1,784	1,134	12,926
Agra	...	39	1,776	403	11,963
Mainpuri	...	146	5,160	1,331	30,144
Farukhabad	...	98	3,376	958	20,535
Etawah	...	191	7,384	3,248	49,300
Etah	...	...	...	...	...
Cawnpore	...	115	4,168	2,120	54,818
Allahabad	...	25	1,016	652	9269
Jaunpur	...	132	3,152	2,022	...
Azamgarh	...	311	4,120	3,050	21,374
Mirzapur	...	7	104	44	...
Benares	...	19	832	456	...
Gorakhpur	...	...	...	...	...
Ghazipur	...	68	1,696	1,832	...
Ballia	...	9	168	138	370
Unao	...	1	32	...	4,019
Fyzabad	...	38	976	529	5,271
Bahraich	...	1	15	12	190
Gonda	...	4	64	37	1,050
Sitapur	...	1	30	17	326
Hardoi	...	6	264	24	1,158
Sultanpur	...	13	280	381	2,203
Partabgarh	...	...	...	...	...
Total	...	1,783	56,941	25,403	3,64,710

RAILWAY-BORNE TRAFFIC OF THE CENTRAL PROVINCES.—The returns of Railway traffic for the quarter ending December 31st. 1885, when compared with those for the corresponding quarter of 1884, indicate a substantial increase in trade. The figures are imports 6,99,332 mds against 5,45,730 mds in 1884 and exports 33,58,343 mds. against 31,86,643 mds. in 1884. The increase is larger than these statistics represent, since it is in great part due to an increase in the imports of cotton goods, which are of course of considerable value and cannot fairly be gauged by weight. It is necessary to add that these figures relate only to *principal commodities*. The chief *imports* of the two quarters are thus compared:—Coal 1,22,467 mds, Cotton yarn and twist 17,396 mds, Cotton piece-goods 47,413 mds, Metals 49,689, Salt 2,29,079 mds, Sugar 94,437 mds. The increase under *coal* is due to an increase in the import of Bengal coal into the Jabalpur block. The large increase under *cotton piece-goods* has mainly resulted from an increase in the import of European goods, which stands at 42,225 maunds during the quarter under report, against 29,585 maunds during the corresponding quarter of the preceding year. This represents an increased outlay by these Provinces of considerably over 10 lakhs of rupees. The other imports do not call for remark.

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The chief *exports* of the two quarters are contrasted thus:—Cotton 44,887 mds, Wheat 16,52,248 mds, Hides 17,200 mds, Linseed 3,81,884 mds, and Tilseed 1,11,536 mds, The export of *cotton* has been exceptionally brisk owing to the excellent outturn obtained this season. The increase in export represents a value of at least 5 lakh rupees. The export of *wheat* shows but little difference from that of 1884. Out of the 16½ lakhs maunds exported no less than 10¾ lakhs maunds were subscribed by stations in the Narbada valley, a large portion of which was in reality Bhopal produce. Of the amount exported from the Nagpur block 41,509 maunds had been received from Chhattisgarh and should be credited to the latter block. It is worth notice that the Nimar block imported 17,040 maunds wheat—mostly from the Berars. Nimar regularly imports wheat for consumption and received 14,126 maunds during the corresponding quarter of the preceding year. The decrease under *hides* is a matter for congratulation, since it indicates that there was less mortality amongst cattle during last rainy season. The export of *linseed* calls for no remark. The large increase in the export of *tilseed* is the result of a good crop.

The Nimar block figures prominently in regard to the trade in tilseed, contributing 44,704 maunds out of the 1,11,536 maunds exported.

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Up to the end of the quarter commercial prospects looked decidedly bright. But at its close the export of wheat showed signs of falling off, and it has since decreased to a remarkable extent. Up to the present date the wheat exports since October last, are less by 12½ lakhs maunds than they were during the corresponding portion of last year, and export has now dwindled down to very small dimensions. The explanation appears to be that the stock of last year's grain, available for export, has been exhausted. That the supply was rapidly running short was indicated by a sudden rise of prices ruling at Jabalpur and at markets in the Narbada valley. At the present time wheat is selling in the Saugor market at 15 seers per rupee, whereas in November last the rate was 26 seers. Prices have not risen so markedly in the southern districts and in Chhattisgarh, but the quantity of wheat which is brought to the railway for export in these tracts also is comparatively insignificant.

PATENT LIME PROCESS FOR IMPROVING THE COLOUR OF INDIGO. This process consists in the use of lime in the manufacture of indigo, in fixed and ascertained quantities, for the purpose of improving the colour of the dye. For many years the beneficial effects resulting from newly plastered vats have been well known, and new factories have been known to make far better colour the first two or three seasons than they were ever known to make in after years. These results can only be traced to the action of the lime, which everywhere predominates in new factories or in newly plastered vats. The superior colour made by new factories, is often put down to the fact of the lands being new, but this can hardly hold in the case of the lands being already old, which is oftener the case than not. In the case of a factory where a new well had been built, during the manufacturing season the well fell in, and for two days the water which was pumped up, was charged with lime and mortar,—the result was that the indigo made on those two days, was by far the best. Again, factories famous for their bad colour have been known suddenly to turn round and make some of the finest colour in the market, owing to a whim of the Manager in having his vats plastered right through. Many more examples, such as the above, could be quoted, but there is no necessity for doing so. The process consists, as stated above, in the use of lime in measured and fixed quantity, sufficient for effecting certain chemical changes, which bring about an improvement in the colour. This quantity must of necessity be very accurately determined, for to use lime largely in any part of the manufacturing process, would be sure to injure the colour. For this purpose, a simple and very accurate test has been introduced, which is capable of indicating the exact amount of lime to be used. The lime, it must be noted, is neither added to the beating or steeping vats, but applied to the water in the reservoir. After the addition of the lime, a small quantity of water is submitted to the test, which turns brown if there be an excess of lime, does not change colour if there be an insufficient amount, but assumes a slight yellow tinge when the right proportion of lime to the water has been attained.

The chemical action of the lime is threefold:- *Firstly*, it softens the water by uniting with the Carbonic Acid in the water to form Carbonate of Lime, and by precipitating the salts which render the water hard. *Secondly*, the water is rendered *alkaline* and deleterious Acids (the natural products of fermentation) are neutralized. *Thirdly*, vegetable matter held in solution by the water is precipitated. The value of soft water in indigo manufacture can not be denied. It is a better solvent and will more readily take up indigo in solution. In nearly all manufacturing operations where water is used, soft water is preferred to hard. In fact, it has been found in working the process, that the results are more marked in cases where the water of a river was low and comparatively hard, than when the same river was swollen with late rain and the water consequently soft. The advantage derived by the rendering of the water *alkaline*, and neutralization of acids should be well appreciated, for all acids have a most deleterious effect, not only on indigo, but on all vegetable dyes. The nature of acids is to destroy vegetable colour, and nitric acid, one of the acids formed during fermentation, will, in sufficient strength and quantity, bleach indigo. Furthermore there are some waters which are so charged and saturated with vegetable matter that they are unable to take up indigo in solution in other than small quantities, thereby giving a small produce, and the colour manufactured from such waters is generally bad. The addition of lime to the water will cause the vegetable matter to be precipitated. Such then are the chemical advantages to be derived from the use of lime in the proportion determined by the test. In the case of new vats, the lime in the plaster being in a hard and insoluble state, brings about the above chemical changes, but

only in small degrees, decreasing with the use of the vat. In the case of the Patent Process, the correct amount of lime can be added at any time with but little expense or trouble. The test is as absolutely certain as it is simple, and with it, lime may be safely used and all the beneficial results of which it is capable may be attained, without fear of injury to the colour. For the proper working of the process, only lime of the very finest quality should be used and after application, the water should be allowed to remain quiet for some time, that the full chemical action may take place, and to enable the heavier particles of lime which remain in a free state to precipitate. The lime-charged water should never be used for the beating vat, or the boilers, *unless* the lime, after application, is allowed to settle, and in this case the limed water is preferable to the ordinary. Another and more correct way of working the process, would be by the use of what is known by chemists as *lime-water*, it would be slightly more expensive, but the results would be more satisfactory.

1. Railborne Traffic of the Central Provinces for the quarter ending 31st March 1886 : From Govt., Central Provinces.
2. Trade and Navigation Report for March 1886 : From Govt. of India.
3. Wheat and Cotton Forecast of the Bombay Presidency for March 1886 : From Govt. of India.
4. Return showing the cultivation and production of Indigo in the N. W. Provinces and Oudh for 1885 : From Govt. of India.
5. Journal of the Madras Agricultural Students' Association for January 1886 : From the Secretary.
6. March Forecast of the Wheat and Oilseed crops of the United Provinces ; From Govt. N.-W. Provinces and Oudh.
7. Report of the Agri-Horticultural Society for April 1886 : From the Secretary.
8. Memorandum of the Wheat and Oilseed crops of the N.-W. P. and Oudh : From Govt. of India.
9. Memorandum and Prospects of Wheat and Linseed crops in Central Provinces for 1886 : From Govt. of India.
10 Selections from the Records of the office of the Financial Commissioner, Punjab : From Punjab Govt.
11. Report on the Land Revenue Settlement of Siba Jagir, Kangra District, Punjab : From Punjab Govt.

Thanks of the Editor are recorded for all the above contributions.

BARAHPUR AGRICULTURAL SHOW.

DEAR SIR,

At last I am in a position to send you a report on the Agricultural Show held this year in connection with the first of the annual Barahpur fairs. These cattle and horse fairs occur twice a year, the former generally in February and the latter in April. The actual period of their incidence depends on the moon and this year the former festival like Easter was unusually late not commencing till the beginning of March. The village of Barahpur or as it is more commonly called Kat-Barampur, is situated south of the Ganges about three miles from the Raghunathpur station on the East Indian Railway. The fairs held here are second only in importance to the great Sonpur *melas.* This fact which would ensure a large attendance of the cultivating classes, and the propinquity of the place to those well-known supporters of Agricultural interests, the Maharaja of Dumraon, and Messrs Burrows Thompson and Mylne of Beheea, decided the agricultural Department to hold an Agricultural Show in connection with this Fair.

The subdivisional officer Mr. Genkins who had gained his experience as Secretary at the Dumraon Show last year kindly consented to act again in a similar capacity. The Collector of the District Mr. Power was elected President of the Committee of management. Handsome subscriptions, notably Rs 500 each, from Beheea proprietors, and the Maharaja of Dumraon were promised, and the Prospectus and List of Prizes were issued as early as possible. Assistance was asked for and obtained from the adjoining districts where those interested in agriculture formed Local Committees who collected exhibits, and after selecting the best products from their districts forwarded them to the Honorary Secretary at Barahpur. This process of election added largely to the attractiveness of the Show, and moreover diminished to an appreciable extent the labours of the judges in each class. When each class is overloaded with numerous exhibits many of which are of an inferior character, spectators become wearied before they have seen half the objects worthy of admiration; but when, as in this case, the work of selection is carefully done, the visitors are only shown the best samples in each class and they gain far more advantages from the Show than if they had been compelled to sift the wheat from the chaff.

The show which was held in open sheds constructed under a grove of trees a few hundred yards from the Fair, was opened by the President on the 4th. March, and it was soon crowded by a conti-

nuous stream of visitors who stayed till night fall, appearing again every following morning for the three days during which the Show was kept open.

4. The Exhibits were arranged in five Departments which were divided into classes.

DEPARTMENT I.—CLASS A. CATTLE.

The committee anxious to attract the owners of good plough bullocks even from a distance had offered a prize of Rs. 50 for the best pair of plough bullocks, but the number of competitors were not so large as had been expected. The first prize was won by Ram Sagan Thakur of Gangowli in the District of Shahabad, and the second by Ramcharn Ahir of Harkhaelli in Saran. The Maharaja of Hatwa won the first prize for cart bullocks, Tika Gwala and Maulwi Fayl Nuane both of Patna won the first prizes for the best bull and cow respectively. These animals showed traces of the English strain introduced into Patna by Mr. Taylor when Commissioner thirty years ago. If the good effects of a superior breed are discernible after so long a period when no attempt has been made to keep the breed pure how much greater would be the effect on the cattle of the country, if some of the great landowners would take up cattle breeding on scientific principles. The high position held by the different noted breeds of cattle and sheep in England is entirely due to the private enterprise of men like Bakewell and his followers. The same might readily be done by the large landowners of Behar where the soil and climate are well suited for breeding purposes, and by so doing they would not only benefit their tenants, but might fairly expect to make a considerable profit. However this is a digression for which I must apologise. The other exhibits in this require no special comment.

CLASS B.—SHEEP. Ahmad Hussen of Patna carried off the first prize with a fine four horned ram which excited the admiration of those unacquainted with this breed ; while Debi Garerį of Buxar was awarded the prize for a flock of sheep. This class was rather poorly represented.

CLASS C.—POULTRY. It excelled more in quality than quantity. Maulvi Fayal Imam of Patna secured first prize for a cock and pair of hens the descendants of some Cochin Chinas introduced by Mr. Albert Mangels when Collector of Patna. The same gentleman carried off the first prize for the best collection of pigeons. The competition under this head was very keen as pigeoh breeding is a favourite occupation in Behar.

DEPARTMENT II—AGRICULTURAL IMPLEMENTS.

The main interest centered round the Ploughs and in order to test the qualities of the different ploughs and at the same time to publish their merits as widely as possible, ploughing matches with ordinary bullocks were held every morning. There were fourteen different ploughs tried in succession, and of these three were selected by the Judges for a final trial. One was the well known *kaisar*. valued at Rs 5 the second was the "Bengal" Plough a joint invention sent by the Superintendent of the Barakar Iron Works, and the third which was completely made of iron was invented by Mr. Hossen M. R. A. C., Assistant to the Director at Bhagalpur. The last named plough gained the first prize, and the Bengal plough towards whose creation Mr. Sen M. R. A. C. had much to say was second. Either of these ploughs can be obtained through the Agricultural Department for four rupees. Neither of them is perfect nor can it be expected, that any cheap plough will ever perform all the agricultural operations necessary on different kinds of soil, but each of these two ploughs is within the means of an ordinary cultivator. Both of them are light enough to be carried on the shoulder in the ordinary way, and both have mould boards which turn over the soil to a depth of from five to six inches. The result is that numbers of these ploughs have been sold especially in Bhagalpur, and of a hundred Bengal ploughs sent to the Show all were disposed of in the districts of Patna and Shahabad.

It would take too long to describe all the new implements which gained prizes, but I must note a very neat little corn-sheller sent by the Agricultural Department N.-W. P. which worked by hand did its work rapidly and effectively. Of machines for raising water the best for lifting water for short distances up to 20 feet was the well known Cawnpur water lift. From the same place came working models of a double *moth*, and of a single *moth* requiring only one man and one bullock, both of which appeared to be improvements on the ordinary country moth employed in Behar. Considerable interest was attracted by a centrifugal machine for converting *rab* into *chini*, invented by Messrs Burrows Thompson and Mylne of Beheea. This machine will extract 20 *seers* of *chini* from one maund of *rab* in a few minutes, and from the resultant treacle 15 to 16 seer of *gur* can be made. When one remembers that the ordinary process of obtaining crystallized sugar takes several days, the beauty of the new method is obvious. The initial cost of the machine is about Rs. 400 but so great are its merits that some astute cultivators in Shahabad

have already invested in them and have been making large profits by buying up *rab* from their neighbours and manufacturing *chini* and *gur* on a somewhat large scale.

Department III—Class A, Grain.

The exhibits under this head were numerous, and samples were sent from lower Bengal and the N.-W. P. They were arranged in open bags each with a ticket showing the name of the grower and the place from which they came.

The Judges were assisted in the difficult duty of awarding the prizes by selected cultivators and grain dealers, who in fact did most of the actual judging, the ostensible judges doing little more than seeing that the merits of each specimen were carefully considered. The largest number of competitors entered for the prize for winter paddy. There were over two hundred exhibits and the prize was eventually awarded to the Demonstration Farm at Dumraon. The excellence of this grain was mainly due to the crop having been top dressed with saltpetre. Mr. Sen also gained first and second prizes for paddy sent from Burdwan.

The first prize for the best Table Rice went to Luchman Tewary, a Gaya cultivator, while Patna which is generally believed to be the best district for rice had to be content with second place.

The first and second prizes for white wheat instead of going as might have been expected to cultivators from Buxar, were carried off by two *ryots* on the Beheea estate. Of the remaining cereals the most noteworthy were specimens of American and Canadian corn, and Cape mealies grown from acclimatized seed by Mr. Maries of Darbhanga. The cobs were much finer in appearance than the usual Indian corn, and the cultivation of these special kinds should be encouraged. The exhibits under *millets*, pulses and oilseeds were respectable but require no special comment, except that a large proportion of the prizes went to Babu Bhupen Singh, the Government Pleader at Gaya.

Classes E, F, G, Raw fibre, spices and miscellaneous things—were not of much interest.

Department IV.—Vegetables and Fruits.

Considering the lateness of the season the show of vegetables was remarkably good. The largest winner of prizes was the Superintendent of the Buxar Jail which tends to show the superiority of the general manure used in Jails to the more expensive manures applied in ordinary gardens. The competition among the *malis* for the best *Dali* of European vegetables was very keen. Eventually the first prize was awarded to Beheea while the Collector of Patna and the Buxar jail were highly commended.

Department V.—Manufactures.

This Department was as usual very popular, and the sheds containing them were invariably crowded. Unfortunately I had no opportunity of going carefully through the exhibits in this Department, so I must confine myself to the few articles I remember. There were good carpets from Buxar, Sasseram and Bhabhna, while Dinapore excelled in Tat Newar and leather work. There was a beautiful collection of imitation fruits sent by the Maharaja of Hatwa, of which the artist was one Hanuman Parshad. He also won the prize for common earthenware pottery. Could this artist but combine the useful with the beautiful instead of excelling alternately in each, he ought to be the Wedgewood of India. The well known black stoneware of Gaya was suitably represented, as a special prize was awarded to some neatly painted saucers done by one Supan Kamangar of Sasseram. The best prize on the list for the Best cart was awarded to Mr. Robertson of Partabpur Factory who sent a strong wooden cart filled with iron nuts, screws and tires. The price for which he says he can sell these carts, viz Rs. 25 is surprisingly low. I should advise any of your readers who want a really good strong cart without a bit of string fastening about it, to apply to Mr. Robertson for one of these carts, for they really are wonderfully cheap at the price mentioned by him.

I must apologise for the length of this report, but the Show excited so much local interest that it would have been unfair to treat it more briefly. All the prize grains were made over to the Director of Agriculture who has I believe passed them on to the Chamber of Commerce in Calcutta for report. Over Rs. 800 were given in prizes, but I am not able to mention what was the total expenditure on the Show as the amounts have not yet been published.

Bankipur D. B. Allen.

FORECAST OF CROPS IN BENGAL.

ANY one interested in the cultivation and trade of the staple food and industrial crops will have noticed the dearth of any information in Bengal as to the area sown and the prospects of the crops between the time of sowing and reaping, similar to that furnished by the Agricultural Departments of the North-Western Provinces, Punjab, Bombay, Assam and British Burma. We are glad to see that the first step towards the publication of such fore-casts of crops is being taken in Bengal. It was suggested that materials for these forecasts might be collected through the Police or Revenue authorities on the principle of showing for each village whether it grows much, little or none of each crop. It was also urged that forecasts of wheat and other staple crops are prepared in the North-Western Provinces from information supplied by private landholders and there would at first sight seem to be no reason why the same thing should not be done in Bengal. Let us see what Mr Finucane, the Director of the Agricultural Department in Bengal has to say on the feasibility of either of these two steps.

"The plan of collecting such information through the present staff of Revenue authorities seems to me to be impracticable. There are at present not more than some ten or twelve Revenue officials in an ordinary Bengal district, and they are responsible for the entire work of administration, extending over an area, on an average, as large as half of Wales, and for the government of a population equal to two-thirds of that of all Scotland. That these officers, already overburdened with work, should be able to devote their time to the ascertainment of the fact whether there is much, little, or none of a particular crop grown in every village in the vast areas under their control, is therefore, it will be seen, entirely out of the question. The magnitude of the task which would have to be undertaken in the compilation of such returns for the entire province will be understood from the fact that there are 264, 765 villages in these provinces, and that a mere list of these villages, with the names written down an inch apart one from the other, would extend beyond a distance of four miles. But assuming that Revenue officers might show for each village, whether it contained "much," "little" or none of a particular crop, the informations when obtained would not afford the means of preparing estimates of the areas under that crop, and would be of little practical value. A Collector of a district or sub-Divisional Officer can now say in a general way whether his district or sub-division grows much, little, or none of any particular crop, and we should get no further by saying the same thing at the cost of much labour for each village.

"Nor, it appears, can such statistics be collected through the agency of the Police. Apart from the consideration that it would be highly inexpedient to allow the Police to institute inquisitorial investigations in matters of the kind, and setting aside the objections which the Police authorities would certainly urge against the diversion of police constables from their legitimate police duties, there is the further objection that any statistics which the Police could collect would be mere guesses entirely unworthy of trust, and they would have the defect, as compared with the estimates of Revenue authorities, that they would be the guesses of untrustworthy and unintelligent persons instead of being the guesses of intelligent and disinterested authorities.

"But I would beg to point out that the normal area under each crop is known from the settlement and putwari's record in the North-Western Provinces. When, therefore, we are told that the area in any particular year is so many annas, more or less, than the normal area, a definite idea of area is conveyed, and figured estimates can thus be formed; but there, being no field-maps, survey records, or returns of cropped areas in Bengal, the total area under cultivation is not known, much less is the normal area known which is sown under any particular crop. Therefore it is that information such as is supplied by private zemindars in the North-Western Provinces would not, if supplied in Bengal, afford the means of arriving at any conclusion as to the area under jute, rice, or any other crop at any particular time."

It is clear from above that materials for forecasts of crops similar to those of other provinces, cannot be collected in Bengal either by the Revenue or by the Police authorities, nor, if collected by them, would they be of any practical value. Without field maps, village records or returns of cropped areas of which there is none in Bengal, information such as is supplied by the Zemindars in North-Western Provinces would not, if supplied in Bengal, afford the means of arriving at any conclusion as to the area under jute, rice or any other crop at any particular time. For the collection of statistics of cropped areas and the probable out-turn, Mr. Finucane lays before the Government two alternative proposals, viz., that either an agency must be created and paid by the Government for the purpose, or an obbligation imposed on the landholders to file returns, showing aproximately the areas sown under such crops as may be desired by the Government. We who have better oppor-

tunities of knowing the landowning class of our country] believe that, pending the execution of cadastral survey and formation of village agency, fairly approximate estimates of areas and outturn of crops can be collected by the agency of Zemindars, but the means to get at them is not the application of threats or the passing of any compulsory legislation. Reciprocity of good will can do more than any amount of compulsory legislation.

As a tentative method, Government has sanctioned the proposal made by the Director of Agriculture that the Commissioners of the principal Divisions in which jute is grown, namely, Rajshahye, Dacca, Chittagong, the Presidency and Bhagalpore should be called upon to select those gentlemen, European and Indian, who have the best means of giving the desired information and that these gentlemen should report to the Director of Agriculture both as to the area sown and the prospects of the crop between the time of sowing and reaping. The Government has also expressed a desire that the steps necessary for giving effect to it may be taken at once, so that all the requisite arrangements may be made in time to publish a forecast of the coming jute crop. The weekly reports at present submitted by Collectors on crops, weather and prices will also at the desire of the Government be so arranged in future as to make them serviceable as materials for forming forecasts of the extent of rice under cultivation and of the prospects of the different harvests. The forecast of area and outturn thus arrived at will, it is evident, be at best only rough approximations and must therefore be accepted with great caution. The words of Mr. Finucane on this subject is well worth reproduction.

"In conclusion, I would add that, though I think it possible to prepare forecasts of crops in Bengal to the extent and upon the data mentioned in this letter, I am at the same time of opinion that there is great danger that the limitations, subject to which such forecasts can alone be prepared in these provinces, are likely in time to be lost sight of; that a fictitious importance may be attached to these forecasts as being issued under official authority, and therefore that it may be questioned whether it is worth while to attempt to prepare them at all, unless and until a suitable agency is provided for the purpose, such as exists in all other provinces of India."

RURAL ECONOMY OF SHAHABAD.

[From the Dairy of an Agriculturist.]

BUXAR.

MUSTARD.

Varieties.] The different varieties grown here are Rai, Tari, Maghi-Tari and Saro.

Soil] It is grown both on *dorus* and *karil*, but does best in the former.

Rotation and tillage] It is sown after Sama, Tangan, or Maize, but, does best after *choumas* or four-month-fallow. If after choumas, the land is begun to be ploughed in August (Sravan) which is repeated at intervals till sowing time. If after *maize* or *sama*, ploughing begins as soon as the *bhadai* crop is off the field, namely, in September October (Aswin), and is repeated four times at interval of a week between every two ploughings. Henga or harrow is then applied and seeds sown broadcast at the rate of 4 seers per bigha ($\frac{1}{3}$ acre.) The sowing continues during the whole of October (Kartic) and henga applied after sowing. The land requires weeding twice at intervals of a month.

Harvesting] It is repeated in March-April (Phalgoon-Chaitra.) The grains are either beaten off or threshed by bullocks. The cultivators generally keep a litle of the crop for their own use and sell the remainder at the Buxar market. Sometimes *mahajans* come and buy at the houses of the cultivators.

Manures] Ashes, cowdung, poudrette, etc, are applied as manures after the *bhadai* is off the field.

Weather] If it rains in the *hatia nachchatra*, that is, in the month of September and October (Bhader-Aswin) followed by continued sun shine, it is good for mustard. If it rains after germination and sun shine follows, it is also good for mustard. Rain at the time of flowering is very injurious. Rains after the flowering time is over do not cause any loss till when gathered in the yard.

Diseases] When it is cloudy and sultry and the east wind blows, a kind of insect called *lahi* attacks and destroys altogether the newly formed pods.

Irrigation] The crop does not require much water and is seldom irrigated more than once. Usually rain water is enough.

WHEAT

Varieties] Two varieties are grown here, namely, the red and the white called *doodhia*. The white is is not much grown, for if grown continually in the soil of Buxar, it becomes red.

Soil] For wheat *karil* soil is best and next to that *siget*.

Rotation] It follows rice in karil and maize in siget lands. But the crop does best on lands which have been ploughed and prepared since June (Ashar). This process is called *palihar* (choumas.)

Tillage] In the case of choumas, ploughing begins in June (*Ashar*) and is repeated as many times as possible, say, at intervals of a fortnight. As often as the land is dry enough for ploughing it is ploughed. In case wheat is to be sown after maize, ploughing begins as soon as the latter is off the field, that is, in September, and henga applied after every ploughing. Maize however should better be followed by peas. After last ploughing in September (Aswin) henga is applied and seed sown at the rate of one maund (82 lb) per bigha or ⅓-acre. The crop is irrigated once or twice as the case may be, once after the plants are a foot high and once when the ears are comming out.

Harvesting.] Harvesting begins in Chaitra (March) and ends in Baisakh (April). The sheaves are heaped together in one place and kept there for about 3 weeks till they are quite dry. Wheat is threshed by being trodden by bullocks, then collected in one place and winnowed by the swoop. The straw is eaten by the bullocks and the grains consumed at home or sold to *mahajuns* or grain-dealers.

Manure.] No manure is used except by the Keoris. Old cowdung is very good and the best time to apply it on the land is Asar (June).

Diseases etc.] Wheat suffers from *rust* and is sometimes also frosted, especially in moist places. A disease called *harda* and another called *garei* also attack wheat plants. In the former the leaves turn yellow and in the latter they turn red, hence the names. Wind blowing from the west is good for wheat. If there be any accumulation of water in the field or if it rains continually for a number of days, wheat is destroyed. The crop is altogether lost if it rains at the time of flowering.

MAIZE

Variety.] There is only one variety grown in this neighbourhood.

Soil.] In years of heavy rainfall maize delights in *bangar* soil. But if there be less rain or if plenty of water is not available, *karil* is better. *Dorus* or *Siget* is not so well suited for the crop.

Tillage.] Maize is a *bhadai* crop and one first reaped. Agricultural operations begin with the ploughing of the land for maize or sira, which begins with the first rainfall in June. The land is generally ploughed four times and, if there be weeds, *henga* is applied after each ploughing. Henga is dispensed with when there are no weeds. For sowing the seeds, one man opens the furrows with a plough and another puts the grains in the furrows, one at a place six inches apart. The furrows are also six inches apart. The land is weeded when the plants are about six inches high, after which it is harrowed. Another weeding is sometimes given in dirty fields. Generally speaking no irrigation is necessary, but if there be no rain at all, the crop is irrigated once or twice.

Harvesting.] It is harvested in *kuar* (August-September).

SUGAR CANE

Varieties] Four varieties of sugar-cane are grown in this neighbourhood, namely, *barokha*, *agholi*, and *chin* all used for sugar-making and another used only for eating raw.

Rotation] Sugar-cane either follows a year's fallow or rice. Occasionally it follows gram, sometimes it is grown mixed with peas and onions, sometimes on irrigation ridges. Hemp and castor-oil plants are sometimes grown on the borders of cane-fields. But cane is generally grown alone.

Soil etc] Sugar-cane grows best on loamy soils, and requires heavy manuring. 150 to 200 maunds of cowdung per bigha or ⅓-acre is not an uncommon dose. The practice of herding sheep on the land during night is not unknown. The cowdung is applied shortly before planting and well mixed with the soil.

Tillage] Ploughing begins with the rains and is continued till planting time, except that the land gets rust during November, as ploughing during this month is believed to encourage weeds. The cuttings each of which consists of two or three nodes of a cane are kept buried for a few days in damp earth. They are planted in open furrows at least left apart. It requires about 20,000 cuttings in one acre, which represents 3,000 to 5 000 pieces of cane. Sometimes canes, are ratooned, that is, allowed to grow from the stumps of the previous year's crop. The juice of the second year's crop is more sweet but is less in quantity: The land which is to receive the cuttings is irrigated once before ploughing and three or four times or more if necessary afterwards till rains commence. *Khari* water, that is, water with nitrate in solution is bad, as it spoils the quality of juice. Sometimes the ground is left covered with grass six inches deep to prevent rapid evaporation. This practice is called *palwar*. The land is generally weeded twice but hoed three or four times with a small pickaxe to a depth of from six to nine inches.

Harvesting]. Harvesting begins in November, but the usual time is January when the juice gets richer.

Outturn.] 100 pieces of cane yield about 50 seers of juice from which are obtained 19.5 seers of rab. 19.5 seers of rab yield, 6.5 seers of molasses and 13 seers of *asara* from which latter 6.5 seers of sugar (chini) and 6.5 seers of molasses are obtained. Thus the proportion of sugar to rab is 1 to 3.

BUTTERINE.

The English dairying public seems to be in a great ferment over the question of butterine. Butterine, oleomargarine or artificial butter, as it is variously called, is one more example of the manner in which the inventions of science in recent times have revolutionized the industrial world. It may be interesting to our readers if we go a short way into the history and manufacture of this important article of commerce which has so much ruffled the equanimity of the English dairy farmer. It is curious to reflect that the manufacture of this common article of consumption with which every housewife in England and on the continent is familiar, has entirely sprung up within the last decade. It appears that the advent of butterine is contingent on the discovery of oil-fields, America, Russia, India and elsewhere. Petrolium or mineral oil has superseded candles in most households, and the enormous quantities of animals fats and tallow which used to be manufactured into candles were thus thrown out of work, till sceince came to their rescue, and made out of them a healthy and nourishing article of human food. The industry has taken deep root in Holland, and the United States but large quantities of butterine are also yearly turned out by English and French factories. The extent of consumption of this article may be imagined from the single instance of England which, so far as we can guess from our experience, is the last familier with its use. At the last meeting of the Cirencester Chamber of Agriculture, Mr. Baham read a paper in which he computed the annual consumption of butterine in the United Kingdom at 1,729,914 cwts worth close upon a million pounds. When we are told that this amounts equivalent to the butter produce of 928,261 cows which are thus displaced, we can understand why the British farmer should be so bitter in mourning over the sad and evil days on which he has fallen.

There are various processes of manufacture now in use, but the one followed by Messrs. Jurgens of Paris and Osh, Holland, here shortly described. The raw materials, beef and mutton fats, are supplied from the extensive abattoirs at Aubervilliers near Paris, in the close vicinity of which the establishment is situated. Fats thus used come hot from the slaughtered animals, and are always fresh and sweet. These are at first chopped into pieces and then pass through a pair of revolving fluted cylinders. The comminuted fat is subsequently melted at a gentle temperature in galvanised metal boilers, which are jacketed and heated by steam on the outside. The melting fat is continually stirred to prevent scorching, and eventually allowed to rest a while, when all the fibrous and membranous matter settles down at the bottom of the boiler. The limpid fat is now siphoned off into tanks, where it is allowed to cool and solidify.

The solidified fat thus obtained is really a mixture of two fats, namely, stearine, and oleine, the latter of which is only available for the making of buttering while the former has a high commercial value, being in great demand for soap making and for the manufacture of fine stearine candles. The separation of these fats is brought about by means of hydraulic pressure which presses out the liquid oleine from solid cakes of stearine which are left behind between the plates of the press. Oleine thus prepared is perfectly sweet and free from all rancid and unpleasant odour. The final process through which oleine passes to be converted into butterine consists generally in mixing with the melted oleine certain proportions of milk and water, and then churning the whole for sometime. The churned mixture is then suddenly run out in thin layers upon sheets of ice, when the mixed oleine and milk fat rapidly solidify up. It is finally made up into pats and packed in every respect the same as genuine butter. The characteristics which distinguish artificial butter, as butterine is too often called, from genuine butter, are not always apparent to the superficial observer. These are (1) that butterine is slightly lower in specific gravity than true butter; and (2) that the proportion of oleine and other liquid fats is somewhat larger in the latter than in the former.

As yet there is no ground for our Indian milkman to be at all anxious about butterine; the economical state of the country, as well as the prejudices and propensities of its people, will for a long time thwart it from being any serious competitor against the native butter and ghee. But that it has excited great indignation and caused much heart-burning amongst the English farmer is a fact which affords much food both for amusement and reflection. It appears that there is an enormous

amount of fraud in the sale of this article, specially in retail trade; the consequence being that more than half the quantity is sold off as genuine butter without the customers even once suspecting its true nature. This is very lamentable, and if we are to believe all that the English farmers say, conscience and honesty are at a great discount amongst the grocers of England. Circumstances often force dishonesty even in the most honest heart, and had the English people taken freely to the use of butterine, the English grocer would not probably have been accused of this gross defection. At present there is a strong outcry against him from all sides, and as the universal panacea for all evils, the dairying interest is particularly loud in its cry for a Parliamentary Act for the suppression of butterine frauds.

CULTIVATION OF COTTON IN ASSAM.

COTTON is grown in most of the provinces of India. In former days our middle-class women used to spin their own cotton and have cloth made out of them, by advancing money to the weavers. Consequently our cultivators used to grow their own cotton. But now a days, Manchester-made cloth has almost wholly displaced country cloth and the cultivation of cotton has almost been forgotten by our cultivating class.

Of the industrial crops, cotton is very valuable. It is usually divided into three classes, namely, bhoga, sundi or white, and tree-cotton. The plants of the first two varieties seldom reach beyond 3 to 4 cubits, besides in appearance there is hardly any difference. But the tree-cotton is easily distinguished from the others.

1. BHOGA COTTON.

The best time to sow the seeds of this variety is from the middle of September to the beginning of October. But in exceptional cases where the land is very fertile and in good condition, it may be sown as late as the middle of October. The quantity of seeds necessary to sow a bigha or $\frac{1}{3}$ acre is 3 seers or about 6lbs. In local vernacular the seeds of cotton are called "Makati" which are never free from fibres of cotton. Hence it is not convenient to sow cotton seeds as they are, because if they are sown in natural condition, the seeds instead of being evenly distributed all over the field, fall in lumps during the time of sowing. Cotton seldom succeeds if the seeding is heavy. There is a common saying amongst our agriculturists, "Mustard should be sown thickly, rape thinly." In order that the seeds should not fall in lumps, they are mixed with cowdung and clay and well rubbed together. About half a seer of seeds undergoes the process of rubbing at a time, whereby they are rendered separate from one another like so many small peas. The seeds are then fit for sowing. After the seeds are sown, the land is ploughed once and harrowed twice.

In most places, cotton seeds are sown on lands after taking *aus* (bhadai rice) off from them. In other places, the practice is to sow cotton on fallow lands. But whatever be the nature of the land, it requires a larger amount of tillage to be fit for growing cotton. A saying is very common amongst our cultivators, "Root crops require 100 ploughings, cotton requires half of that number, rice half of cotton, and pan (betel leaf) none at all." Our cultivators ought not to forget this wise saying.

Fallow lands require 10 ploughings and *bhadui* lands about 5 to be fit for receiving seeds. But it must be distinctly remembered that ploughing is not all that is necessary. About a month after the seeds are sown, the land is completely dug up with a *kodali*. Then about the end of December, after one more ploughing, the soil is heaped round the root of each plant. That this practice is almost universal in the country is shown by the following common saying, "4-ploughings in *Bhadra*, (August,) digging up with spade or kodali in *Kartic* (October,) and ridging up in December yield a bumper crop of cotton." Cotton requires well-drained lands. Water logged and low lands are quite unsuited to this crop.

If there be no rains in December, January and February, the crop is irrigated once or twice where water is available. The stronger and larger the plants become, the greater is the chance of a larger yield. Even if the plants get lodged, they are far from being injured. Therefore it is that the cultivators say, "those that are unfortunate have their rice lodged, the fortunates have their cotton lodged."

From January cotton begins to flower, the flowers being yellow and of medium size. When the floral leaves fall off, the pods begin to increase in size day by day. In this stage, the pods are locally called *Son kushi.*

Most of the pods are three-chambered, each chamber being full of fibres mixed with seeds. When ripe, the pods burst into three parts. In some cases, the pods are four-chambered, and hence burst into four parts.

From March till August, the bursting of the pods continues, and the cultivators begin to pick them. Morning is the best time for picking, as with increase of heat as the day advances, the thin pellicle surrounding the fibres breaks up and renders them dirty.

The cultivators have not usually to pay for picking. Boys, girls, and women of each family go to the fields every morning and select the pods ready for picking. The well-to-do farmers engage servants who pick the first thing in the morning and then go on with other works. Of course when a farmer has got a large area to pick, a very exceptional case indeed, separate arrangement for picking is necessary and has to be paid for accordingly.

The seeds are so intimately mixed up with the fibres, that mere beating is not sufficient to separate them as in the case of *Shimul* cotton (silk-cotton). The wives of the farmers have got a very simple ginning appartus call'ed a *Charkhi*. They move the machine with the right hand giving it a rotatory motion and feed the cotton with the left during which process the seeds are separated from the fibres.

About ½ lb of mustard is sown along with the seeds of this variety of cotton. During the process of digging, some of the mustard plants are destroyed but those that escape the *kodali* yield sufficient out-turn to cover the expenses of cotton cultivation. When cotton is still on the land, very frequently *rahar* (cajanus sativus) and another kind of pulse (Phaseolus) are sown together by the end of June. If tended with care, *bhoga karpas* plants may be kept on for four or five years together, yielding sufficient out-turn every year. But it is very difficult to keep away the cattle.

2. Sundi or White Cotton:

The best time to sow the seeds of this variety is by the beginning of May. The plants begin to flower by August-September. Picking begins in October and continues till May. In other respects, it is very similar to the first variety both in nature and system cultivation, the only difference being that with this variety, the process of digging is replaced by that of weeding. It is enough to weed a land twice. It is sometimes hand-hoed with profit by a kind of curved pick axe by the end of October or beginning of November.

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3. Tree-Cotton. *

Most of the characters of this variety are like those of the second or white variety. But the plants are by far taller and bigger. Once planted, they last for two or three generations. When the plants get bigger and older, 2 lbs. to 4 lbs. of cotton is the the usual out-turn per plant. Very few however cultivate this variety.

A plant or two of this variety are sometimes seen in the yards of cultivators' houses. A few others again plant a few on the raised embankments of their mulberry fields or gardens. Sometimes one single tree yields as much as 8 lbs. of cotton and the staple is not much inferior to American cotton. The fibres are not so much fused with the seeds as in the other varieties and can therefore be more easily ginned.

The seeds of this variety are not sown, but dibbled. The land ought to be made ready for the reception of seeds by the end of March and as soon as the rain falls in April the seeds dibbled at once. It facilitates after-cultivation. The seeds are dibbled in lines, the distance between the lines and the seeds in the same line being about 2 cubits or 3 ft. This can be done by running across the fields thread lines marked at intervals of 2 cubits. Two or three seeds are dibbled at every spot and when the young plants come above the ground, they are thined out leaving one which is the strongest. In the second year, they are thinned again, leaving the plants at intervals of 4 cubits or 6 ft. This facilitates their branching as well as after-cultivation. When the plants arrive at maturity, it becomes impossible to work the plough between the rows of plants. Tillage now entirely depends on the *kodali*. The cotton garden should be dug up by the kodali three times every year, once in April-May, once in June-July, and once again in September-October. This is generally enough to keep the plantation clean. One man can dig 4 bighas or 1⅓ acres of land in two months. From April-May to October-November one man can dig 12 bighas of land thrice over, besides doing other minor agricultural works. From November to March, they are engaged in picking. Plough is not a necessary implement for a cultivator of tree-cotton excepting in the first year. Even in the first year, the plough may be dispensed with and the kodali freely restored to.

There is another practice which can be equally recommended. In April-May when bursting is over, the trees are all cut down leaving only about a foot and half of the trunk. The spaces between the rows of plants are then thoroughly well stirred by the plough and the truncated trees ridged up with the kodali. This process of truncating the trees annually keeps them down to the size of a mere bush and the new branches yield sufficient amount of cotton. Every year the fields should be

* Tree-Cotton here does not mean silk-cotton (Bombax).

manured with well rotten cowdung and earth dug up from old tanks.

Cost of Cultivation per bigha

	Rs.	A.	P.
6 ploughings	1	8	0
Seeds, 3 seers or 6 lbs. ...	0	3	0
Labour for digging, 10 men	2	0	0
2 Ploughings in Kartic (October)	0	8	0
Ridging, 10 men ...	2	0	0
Picking @ Re 1 per mensem for 6 months	6	0	0
Rent, say	2	0	0
Total ...	14	3	0

Gross Profit per bigha.

10 mds. of cotton @ Rs. 3 per md. ...	30	0	0
Net Profit	15	13	0
In case of fallow lands 6 more ploughings cost	1	8	0
In case of land requiring fencing, fencing costs...	3	0	0

The cost of cultivation and the outturn of a plantation of 32 bighas or 10⅔ acres of tree cotton are given below.

Making embankment @ Rs. 3 per bigha	96	0	0
Dibbling seeds @ Re. 1 per bigha	32	0	0
Digging @ Rs. 2-8 per bigha ...	80	0	0
Ploughings @ 8 annas per bigha	16	0	0
Seeds, 32 seers or 64 lbs.*... ...	2	0	0
8 men @ Rs. 5 per mensem for 12 months	480	0	0
Rent @ Rs. 2 per bigha ...	64	0	0
Total ...	770	0	0

Gross Profit.

320 mds. of cotton @ 10 mds. per bigha yield @ Rs. 3 per md. ...	960	0	0
Net Profit	190	0	0

* *Gross Profit in the Second year.*

384 mds. of cotton @ 12 mds per bigha yield @ Rs. 3 per md. ...1152 0

Deduct.—

Hire of 8 men for one year Rs. 480
Rent 64

	544	0	0
Net Profit	608	0	0

In an old tree-cotton garden, one man can easily work 4 bighas during the year. The cost of maintaining a plantation is much less than that of creating one as will be seen from above. Then again the out-turn of cotton in the second year is considerably more than in the first year.

In a cotton plantation date trees can be planted at intervals of 16 cubits and the plantation does not suffer from the effects of the latter. Thus in 32 bighas there will be about 800 plants, or, if the interval be 20 cubits, about 500 plants. The yield of 500 date plants is not very insignificant. Similarly in plantations of date-trees, cocoanut trees, betel-nut trees, cuttings of mangoes, jack-trees, peach trees, lichi trees etc, if the trees are set well apart, crops like cotton, turmeric, ginger, plantain, castor-oil, potatoes, ananas, *ol*, *man* and similar roots can easily be raised in sufficient quantity.

AGRICULTURE OF DROME AND VAUCLUSE FRANCE.

1. AGRICULTURE.

A study of the agriculture of any country does not fail to be interesting, as it exposes how a particular form of husbandry has been superimposed upon a people by the soil they inhabit and the climate under which they live. Its wants and how they are met, the *stimuli* of its progress on the one hand, its impediments on the other, may be also studied with benefit; while a perception of the way in which economics and even politics enter into its constitution and modify it from time to time may serve for a very useful lesson. It is with this conviction that I have gathered into a short notice the most important facts which occupied my attention during my short stay in the south of France, although some of them will appear to be more or less unconnected with the mission I have been entrusted with.

I have treated Drome and Vaucluse as a whole, noticing on the way such differences as may exist between the two departments. The supreme role which irrigation plays in the south of France identifies it almost with agriculture itself. The second part of the report has been, therefore, wholly devoted to irrigation.

The Valley of the Rhone may be described as a narrow plateau rising slowly from the sea towards the north, and confined within two parallel ranges of mountains on its two sides. The departments of Drome and Vaucluse are contiguous to each other; they are flanked on the east by the Hautes Alpes

and Basses Alpes respectively. The rocks which compose the mountains are a light limestone, at times pierced through by veins of volcanic clay. Besides they often include highly fossiliferous beds of fine sedimentary clay. The soil is generally a light calcarious gravel; clay soils are not, however, unknown. The loose gravelly nature of the soil aggravates the evils of an extremely dry summer. The little rain that may fall on it at times filters away as through a sieve; while, being extremely loose, it has not the porosity to draw up water from the subsoil. Such soils are known as *garrigues* in Vaucluse, where they seem to be commoner than in Drome. When submitted to irrigation and properly manured, they give excellent crops, elsewhere they are almost nude of vegetation in the height of summer. A considerable extent of *garrigues* has been reclaimed and fertilized in Vaucluse by a system of warping, known as *calmatage* in France. I have given a brief description of it later on under the section on irrigation.

In Drome, and particularly in Vaucluse, springs and marshes are very frequent. Their growth is favoured by the loose character of the soil, which permits rain-water to descend quickly through it till it finds vent in springs; or otherwise, when cooped up, it gives rise to marshes. Of springs, the celebrated Fountain of Vaucluse, which has given its name to the department, is an example. In the last few years the State has made considerable outlays in the drainage of marshes.

The climate of the south of France is very favourable to agriculture. Its main characteristics are a dry hot summer and frequent storms. At high altitudes the winter is exceptionally rigorous. Thanks to the snow and rain that fall abundantly on the mountains, rivers and springs never fail; the disastrous effects of a rainless summer are thus partly avoided through irrigation. In the valleys the winter is mild and short. Vegetation pushes up quickly with an early spring, but young buds and leaves are very often destroyed by cold north winds as late as May. The little rain that falls in summer comes in torrents, the number of rainy days is hence very limited. The first rain fell in Drome last year on the 14th July, the day of the National Fete, after three entire months of continual rainless weather. Evaporation is further encouraged by the "mistral," a cold hungry wind from the N. N. W. Being an extremely dry wind it absorbs moisture with singular avidity, when it passes over the warmer region of the south of France. Vegetation withers away during its passage, even cattle and sheep suffer from it. The frequent storms which sweep over the country destroys very often the hopes of the cultivator by laying down corn, beating down fruits, and in numerous other ways.

In noticing the agriculture of Drome and Vaucluse, it is first to be remarked that property, as elsewhere in France, is also very much sub-divided here. Thus, out of 100 cultivators in Drome, 70 are known to hold under 12 acres. On such diminutive farms the grandeur of high farming is unknown. For the most part the peasant and his family suffice for the cultivation of his little property. Servants are seldom kept unless when the farm is too large or the owner is otherwise unable to work for himself. In the last few years labour has grown very dear in the country, where a good day labourer will not work under 2 fr. 50 c. or 2s. a day. The smallness of the farms does not often allow of horses being kept. The smaller peasants serve themselves with cattle for working their fields. It has been estimated that fully 75 per cent. of land is thus cultivated by means of bullock labour. A good deal is also done by the spade, which is greatly valued by the peasants.

The agricultural implements in use are generally as simple as the peasants who are to wield them. On the larger class of farms one often meets with the mowing machine, and a few other implements of an improved type. In the last few years locomotive threshing machines have become frequent in the country. Their charge being very high, about 2s. per quarter, the peasants prefer to thresh their corn by the old system of stone rollers driven round and round a peg by horses or cattle. The ploughs are as often wheeled as wheelless, but in either case composed entirely of wood, except in the share and mouldboard. The wheeled ones being too cumbrous, give, in my opinion, little satisfaction. However simple, nay rude, these ploughs may be in point of construction, their cheapness is a great recommendation in the eyes of peasants' with whom present economy counts far more than future gain. Their tools may want in finish and elegance, but, for the matter of that, when handled with the care and skill which a born peasant alone can give them, they serve their purpose not less efficaciously than the finished and costly implements of high farming.

In common with the rest of Western Europe, France is passing now through a severe agricultural and commercial depression. The crisis which weighs on the whole country has still farther accentuated its sufferings in the south of France. It is not yet very long since vine, mulberry, and madder used to be the principal crops of the peasants. Live stock found a very limited place, and that only at high altitudes, where the soil was naturally fresh, and af-

forded abundant herbage for the rearing of animals. Corn was grown only enough for the household. But generally speaking wine and silk cocoons were the two most important commodities destined for sale, those which brought money in the hands of the cultivator. It is not, however, so to-day. Silk has almost failed since the appearance of *pebrine* in 1849 and although the labours of M. Pasteur may have indicated the means of preventing the dreadful malady, the breeding of silkworms in France has ceased to be remunerating. This is largely due to the strong competition which China and Japan now maintains against native silk. The breeding of silkworms rests now only with peasants having a numerous family, and thus able to give it the minute and constant care which it exacts. With hired labour it inevitably entails loss. Mulberry plantations are gradually disappearing, the remaining ones often yielding no return except a paltry sum by the sale of the leaves for forage.

The vine has been largely destroyed by the *phylloxera*, except here and there on certain parts privileged by the sandy nature of their soil. Vine used to be formerly the main-spring of rural wealth in the south of France. Since the appearance of the *phylloxera* about 1869, wine has not only undergone a diminution in sale, but "it has been wanting," says Professor Breheret rather pathetically, "to our peasants and labourers, habituated since their infancy to drink it without counting. In obliging them to drink water or dearly paid beverages, in having no wine but its name, its loss has been to them one of the hardest privations that can be imagined."

While vine and silkworm may be still holding their place against their enemies, madder has had to retire totally from the fields before artificial alizarine * and its derivatives.

In the prosperous times of silk, wine, and madder any variations in the price of corn hardly affected the peasants. Now, since these have failed, it is otherwise. The plough has gone over many vineyards and rich madder fields; wheat has become the chief source of revenue. It can be easily imagined how its extremely low price in these years has cruelly mocked the last hope of the cultivator.

Wheat.—Of corn crops, wheat is the only one deserving mention. The climate of the south of France being extremely dry, the harvest is very poor, the average hardly exceeding 13 bushels per acre. The yield may be much increased by irrigation and manuring; but the peasants are unwilling, from prejudice or otherwise, to water their corn-fields. In Vaucluse, where the peasants have generally abundant water at their command, irrigation of wheat is gradually gaining ground; but the waterings are in any case limited, and not given unless the season be exceptionally dry during the early stages of the crop. The peasants say (and with some reason too) that irrigation tends to increase the straw at the expense of the grain. The following figures communicated to me by Professor Breheret of Valence will, however, show the great utility of irrigating wheat in a dry climate like that of southern France. These embody the results of two year's experiments on the experimental fields of the Agricultural Society of Drome.

*Aniline.

Yield in Kilogrammes of Wheat-crop per Hectare.

No.	How treated.	1883. Corn.	1883. Straw.	1884. Corn.	1884. Straw.	Average. Corn.	Average. Straw.
	No irrigation :—						
1	No manure	800	2,300	1,100	2,500	950	2,400
2	300 kilogrammes ...	1,125	2,325	1,200	3,000	1,162	2,662
3	600 "	1,465	3,325	1,700	3,000	1,582	3,162
4	1,200 "	2,050	4,400	1,900	3,400	1,975	3,900
	Irrigation, with 15,000 cubic metres of water :—						
5	No manure	1,050	2,625	1,300	3,200	1,175	2,912
6	300 kilogrammes ...	1,250	2,800	1,550	3,750	1,400	3,275
7	600 "	1,725	3,625	2,000	4,800	1,862	4,212
8	1,200 "	2,175	4,875	2,650	5,650	2,412	5,262

The composition of the manure applied was as follows:—

Superphosphate of lime	30 per cent.
Potassium chloride	17 „
Ammonium sulphate	33 „
Sulphate of lime (gypsum)	17 „
	100

On comparing the corresponding plots, *i. e.*, Nos. 1 and 5, 2 and 6, 3 and 7, 4 and 8, it will be evident that with irrigation the increase of straw is much higher than that of corn. Thus from 1 and 5, it appears that while the average yield of corn has been increased by 225 kilogrammes or 23·8 per cent., the increase of straw has been 1 700 kilogrammes or 62·5 per cent. So with the other plots. On the other hand, when irrigation is combined with proper manuring, the result is quite the reverse. Thus taking, for example, the two extreme cases of Nos. 1 and 8, we see that the return of corn has advanced from 950 kilogrammes to 2,407 kilogrammes, or fully 153 per cent.; that of straw has increased by only 120 per cent.

The conclusions which follow out of the above figures are important. It is known alike to science and practice that humidity of soil excites the growth of straw; if at the same time the soil has not sufficient mineral matter either naturally or in manures, the formation of the grains will be defective, while the straw will be wanting in consistency and thus liable to lodge. Farmers are afraid of watering their corn, because they seldom think of manuring it properly. Irrigation without manures will certainly give an increased produce, but always at the expense of fertility, and with the accompanying risk of "lodging."

The table of figures given above is very instructive. It shows how much the resources of India may be increased if a better knowledge and better means of manuring be diffused among her peasantry. It is not enough to quench the thirst of the soil; it will, no doubt, be grateful for it and give in the first few years abundant harvests to satisfy its owners, even though at the expense of its own vitality. There is no better means of exhausting a soil than irrigation. A time eventually comes when, however assiduously one may water it, the earth has no more to offer to the growing crop, and consequently refuses to support it. Yet such has been, I am afraid, the fate of many of our soils. In spite of irrigation, in spite of a climate so eminently favourable to vegetation as ours, the yield of wheat seldom exceeds 12 bushels per acre. The experiments of Sir John B. Lawes, at Rothamsted, go to prove the same truth. According to him, our soils have come down to the lowest margin of fertility—or parmanent fertility, as it has been termed by that distinguished scientist.

To return to France. The only manuring given to wheat-fields is farmyard manure which is ploughed in autumn. In spring they receive hardly any manure, as such manuring gives very little result, owing to the dry nature of the soil. I have already spoken of the very low yield of wheat in the south of France. Yet its cultivation continues, even increases at this day as the peasants working themselves their own lands consider too often crop obtained on their own property as having cost them nothing, so long as they have made no outlay for it. It should be added also that wine and silk having failed, a cultivation so easy as that of wheat is bound to extend itself, however reduced may be the return it brings to the cultivator.

The extremely low price of wheat has brought about a severe agricultural crisis in every part of France. Commerce has also dropped at the same time. In the name of the solidarity of agricultural and commercial interests, the Chamber of Deputies passed, early last year, a new law increasing the duties on corn. The tariff of duties established by the law of May 1881 has been increase as follows:—

	Tariff of May 1881.	Tariff of 1885.	
	Fr.	Fr.	c.
Wheat, per 100 kgs. ...	1	3	0
Rye and barley	1	2	0
Oats	1	1	50
Flour	—	7	0

Though the duty on foreign wheat has been thus raised from 1 franc to 3 francs, the actual rise of price has been hardly 1 franc per 100 kilogrammes. Thus, in spite of its good intentions, the new law has carried very little relief to the home of the cultivator.

Forage crops.—Forage crops are gaining more and more ground every year in the southern departments of France. Live stock seems to be the last straw left to the peasants, ruined in so many ways by the evil times on which they have fallen. The dearness of meat, the facility of transport by railways, the introduction of the hay-press, by which large volumes of hay can be compressed into small blocks,—all these have briskly stimulated a rapid extension of forage crops. But for the extremely

dry climate of the country, where not a blade of grass would push in summer without irrigation, they would have taken much larger proportions. In the management of forage crops, Vaucluse, and I may say the south of France generally, can not be surpassed by any other country in Europe. Permanent pastures and lucerne are the only important forage crops, and deserve a special mention.

Permanent Pastures.—In creating a natural pasture, the land is cleared and worked to a fine condition by repeated ploughings, harrowings, weedings, and rollings, it is next heavily manured with farmyard manure, compost, rape cake, guano, &c., one or more combined. In the following years, the pasture receives, either annually or every second year, large dressings of manure. An idea of the intensity of manuring may be formed from the following monographs quoted from M. Barral's Report on the Competition for the Best Employment of Irrigation Water, Vol. II. I have reduced the figures to eight measures:—

Monograph 3.—23 tons of farmyard manure per acre. 5⅓ tons of hay in three cuttings.

Monograph 5.—51 tons of farmyard manure. 5 seven-tenth tons of hay in three cuttings.

Monograph 7.—Manured alternately one year with farmyard manure, and the other with 1¼ cwt. of Peruvian guano mixed with five times its volume of gypsum. Five tons in four cuttings.

Monograph 8.—The pasture has been created by spreading on it 34 tons of compost made of one-third of farmyard manure and two-thirds of ditch and road cleanings. Receives every year 23 tons of farmyard manure. 4½ tons of hay in three cuttings.

Monograph 12.—One year with abundant farmyard manure, and the next year with 16 cwt. of rape cake. 5¼ tons of hay.

It will appear that, all other things being equal, the yield is proportional to the amount of manuring the pasture receives. The peasants seem fully convinced that when they irrigate their pastures they should also manure them highly, otherwise the yield will not be so high as they desire; moreover without such manuring, the pastures will exhaust themselves under the over-stimulation which irrigation calls forth in them. It rests only to point to the very high yields which pastures give here under the combined influence of irrigation and manuring. The highest yield recorded by M. Barral was 6 tons per acre, the average of all yields being 4½ tons. It may be remembered side by side that the maximum yield of hay in England is seldom over 2½ tons, never beyond 3 tons per acre. A prevailing custom in the south of France is to feed off the aftermath, known as the fourth cutting, with a flock of sheep in late autumn. The peasants supply the litter, and in return receive the manures, which the sheep leave on the farm. The advantage of this practice is, however, strongly controverted.

Lucerne.—Lucerne is even more successful than meadows. Its treatment is nearly the same, in point of fact, its roots being much deeper, it does not want so much water of irrigation as meadows. The highest yield recorded was 7 tons of hay per acre, the average being 5 tons. Lucerne loves a hot climate, and as a forage crop exacts a large amount of water. It is one of the plants which can be, I believe, introduced with great benefit in Bengal. I have heard that it has begun to be grown near Bombay, where it is said to have succeeded very well.

Potatoes.—The culture of potatoes is also very excellent. The soil being naturally too dry the result is scarcely satisfactory without irrigation. In Drome, irrigation of potatoes is as yet unknown, here the peasants seem to be afraid of watering the potatoes lest the tubers should rot in the soil. In Vaucluse, where the practice of irrigation is better understood, the peasants have no such fear. On clay soils where water does not filter through quickly there is great danger of rotting the tubers if irrigation is persisted in or given in too large doses. Generally speaking, potatoes should not be watered more often than once a month, or four or five times during the whole course of the season.

Market Gardening.—Market gardening occupies a very important place in Vaucluse. A mild winter and an early summer enable early vegetables to be grown for the Paris market. The secret of its success seems to be irrigation and copious manuring. The manure bill often rises to 10*l.* per acre. The returns are too often fabulous. Thus, M Gamet, one of the prize winners in the competition for the best employment of irrigation water in 1877, is reported to have anually derived from his little property of seven acres a gross return of 6,000 francs, or 240*l.* A continuous rotation of vegetables is kept up, the soil never knows any more repose than its cultivator. Among the vegetables grown in market gardens, I may signalize aubergine and cayenne pepper (or chillies), both natives of hot climates like that of India. The fact that they have mounted so far north as the south of France suggests a very interesting idea with regard to the acclimatization of exotic plants. The winter of India is meteorolgically more or less the same as the summer of temperate Europe. Hence it becomes possible that plants which ripen their fruits in winter of

India may be removed to Europe, where they will gain their fruitage in summer. The reverse holds also good, *i. e.*, that European plants may be in precisely the same way acclimatized in India. The only difficulties in the way are to protect them from excessive cold in the one case and from excessive heat in the other. The nature of soil and situation may affect to some extent, but it generally modifies the quality of the plants rather than impedes their growth.

Of the few lessons which we may learn from the peasants of southern France, the most important, no doubt, is that of manuring. Time has taught the peasants that if they meant to live on the produce of the little morsel of soil inherited from their fathers, they should force out of it as much as they possibly could by means of intensive culture, or, in other words, high manuring and multiplied crops. Beyond what they put in the purchase of chemical manures, they often spend large sums in buying farmyard manure. As a consequence we find that stable manure sells much dearer in the south of France than probably anywhere else, being generally *6s* or *7s* a ton. Nightsoil is also largely utilized in the vicinity of towns, and thus the original fertility of the soil is, in some measure, restituted. In the south of France closets are, as a rule, constructed in a manner to receive the excrement in a sort of ditch below. At night peasants would come to empty them in specially made casks. The nightsoil is next either spread in the dung heap, or mixed up with road and ditch scourings, and thus made into a very rich compost. The peasants use every odds and ends to make up a manure or compost heap.

In reviewing, however shortly, any system of agriculture, the social and moral condition of those who profess it deserves particular mention. All industry and trade are but means to an end, the material happiness of those who live by it. The agriculture of any country would certainly fail, if it did not bring a modicum of ease and comfort to the hearth of the cultivator. It would be no less stigmatized if it did not develope and sustain healthy morals among the tillers of the soil. Thanks to wine, silk, olives, and innumerable other industrial crops which the climate enabled to be grown, the peasants of southern France have been known for long ages to enjoy great ease of life. Their extremely frugal habits have been also greatly extolled. It was the small hoards they thus laid by that enabled France to pay off the enormous indemnity of the war of 1870. Since then the peasants of France have been the load-star of French financiers. "*O tempora, O mores!*" cries M Leconteux, "see our villages that henceforth follow attentively the course of the Exchange."

In spite of the terrible times through which France is passing at present, poverty is as yet almost unknown among its southern peasantry. In a former report I have recorded my impressions in relation to the material condition of the peasants of Finistere. Hapily they have been quite different in Drome and Vaucluse. Here begging is as rare as it is common in Finistere. "There are no poor in the country,"—such was the answer of every one whom I questioned on this point. It used to remind me of Arcadian days rather than these, when people live in a perpetual struggle for life. To take Drome, for example, out of the 376 communes which go to form it, only 190 possess what are called *bureaus de bienfaisance*, or almshouses, and most of them have little or nothing to do. In towns and centres of industry demoralization is, however, active, and it is there alone that the *bureaux de bienfaisance* have any active occupation.

Compulsory education is making rapid progress in the country. The first results have been a little disappointing. It gives the children high aspirations, and when they get older in age, they do not easily do the humble industry of their parents. This partly explains the rapid depopulation which has been going on in the country in favour of towns during the last few years. Unhappily the most intelligent portion of the young generation is thus taken away. Now, it is the reign of the one-eyed among the no-eyed, as M. Leconteux justly observes; in a few years the level will rise, and the state of things will be changed. The extent of emigration, partly due to education, partly to the depression which presses down on the country, may be imagined from a single example, that of Drome, where, on a rural population of ·224,000, the number of emigrants in the five years from 1876 to 1881 has risen to 101,000 or fully 4·5 per cent. of the total population.

NEWS.

Central Provinces

The final report on the prospects of the wheat and linseed crops of 1886 is as follows:—"The area under *wheat* in each district of the Provinces during 1885 86 is shown in a statement annexed (marked A) It should be explained that the figures refer merely to the *Khalsa* area of the Provinces, and do not include the area under wheat in those portions of the Provinces which are held by zamindars or

feudatory chiefs. No detailed (field) survey has ever been made in the Feudatory area and in a large portion of the zemindari area, and no agency exists for the collection of agricultural statistics in these tracts. The omission of the zemindaris affects the statistics of wheat area but slightly, since in none of them is wheat largely grown. But the three Chiefships of Nandgaon, Khairagarh, and Kawardha include a large area of the most productive wheat land in Chhattisgarh, and contribute very largely to the export of wheat from that division.

The total area under wheat in the *Khalsa* is shown to be 3 910,207 acres, against an assumed "normal" area of 3,975,000. This indicates a deficiency of 2 per cent. But the figures which have been taken to represent the "normal" area are not founded on *data* which have any pretence to accuracy, and very little reliance can be placed on the comparison. It is, however, probable that the area under wheat was somewhat less than it would have been had the sowing season been entirely favourable: The monsoon rains ceased early, and over a considerable area the seed was sown in ground too dry for proper germination, although the sowings were pushed on earlier than usual. Fortunately, however, there was a good fall of rain in October, which very greatly improved prospects. In the northern districts and in the Narbada valley, the rain fell before the middle of October, when a large area of ground had only just been sown and the seed had not had time to germinate. The rain did great damage to these sowings, and a large area had to de re-sown. This occasioned a considerable waste of seed grain. But the fresh sowings were made under far more favourable conditions than the earlier ones, and the rain enabled the people to sow a large amount of land which would otherwise have remained fallow. In the south and east of the Provinces the rain did not fall till the end of the month, when it found the previous sowings more advanced, and did less damage. Here too the rain rendered it possible to sow a large area which would otherwise have been too dry for germination, and a very considerable proportion of the Chhattisgarh crop was sown late in the year. The fall of rain at Raipur was exceptionally heavy, amounting to 4 inches.

It will be observed that the area statistics give separate details of the area under soft and of that under hard varieties of wheat. The proportions in which soft and hard wheats are grown are nearly equal. The great extension of the area under soft varieties of wheat, since the export of wheat to Europe has commenced, is one of the most notable facts in the agricultural history of the Provinces, and furnishes an unanswerable argument to those who deny that the Indian cultivator can adapt himself to a change of circumstances. The chief of the soft varieties is that known as *pissi*. In the Hoshangabad Settlement Report, written 20 years ago, *pissi* is mentioned as "a very inferior wheat" grown on a very limited area. But the demand for soft wheat for export to Europe has brought *pissi* to the front rank, and it is now by far the largest grown variety in the district, engrossing two-thirds of the total area under wheat. It may be added in regard to the area statistics that, so far as 12 out of the 18 districts are concerned, they represent the result of a much more searching enquiry than has been made in these Provinces since the last settlement. Until this season the village accountants (patwaris) have never made a field-to-field inspection before compiling their crop returns, and the figures which they have submitted were based on nothing but enquiry from the landholders and cultivators, and very often were mere copies of those returned in the preceding year. But during the past season a field-to-field inspection has been insisted upon; and although it has been in many cases very perfunctorily carried out, yet it has resulted in the submission of much more accurate statistics than have hitherto been available.

The 5th column of the statement shows the estimates of outturn, in annas per rupee, which have been framed by the local authorities, and the 6th column gives the gross outturn in maunds which these estimates give when applied to the estimates of actual average outturn per acre which have hitherto been accepted as the standards. The anna estimates are based on the assumption that 16 annas represent an average crop. Until this season 12 annas has been taken to represent an average crop, and it is suspected that in some cases the estimates have been pitched a little too low from failure to give full effect to the change. Careful instructions were given for basing the anna estimates on the revised standard, but 16 annas is generally taken to mean a full and rather more than an average crop; and so far as the estimates are based on the statements of native officials and non-officials they probably bear reference to a full crop, and not to an average. The estimates are however right in representing the crop to have been over a considerable area of the Provinces very far from a good one. Until January prospects seemed excellent, but a continuance of damp cloudy weather during that and the following month induced blight, which did very great damage. The injury was greater in the southern districts where the crops were generally affected and the weight of produce per acre was often reduced by a half, the grain being shrivelled to half its proper size. The crops which suffered most were those on the best land. A series of heavily manured plots on the Nagpur Farm which had during the last two years yielded over 1,500 lbs. to the acre and promised this year a larger crop than ever, only yielded between 800 and 900 lbs. to the acre.

The gross outturn for the Provinces is put at 240 lakhs maunds. The estimate of last season's production amounted to 26 lakhs maunds so that this year outturn is represented to be 9 % less than that of last year. The "normal" outturn, as calculated from the accepted standards is 303 lakhs maunds, on which the estimated outturn of this season is only 79%. The amount of wheat exported from the Provinces in each of the last three years during the period April 1st. to March 31st. is—

1883-84	...	...	....	78 lakh maunds.
1884-85	...	...	...	99¼ „ „
1885-86				70½

If the export traffic of the next twelve months is affected by the character of this harvest and the character of the harvest has been correctly estimated, the amount of wheat exported should fall considerab-

ly. It has however already been stated that the estimates bear reference to a standard which is rather a full crop than an average, and the deficiency, as compared with an average crop, is probably over stated. It is worth noting that, as far as the exports of this season's produce have gone up to date they show no signs of a decrease when compared with those of last year. Between March 27th and April 24th the exports have amounted to over 7¾ lakhs maunds against 7½ lakhs of maunds in the corresponding period of last year.

The linseed crop has been affected in its area and outturn by the character of the season in much the same way as the wheat crop, but the injury which it sustained from blight was still more severe. The figures differ considerably in some cases from those given in the forecast of January last and are believed to be more reliable as they have been checked more or less carefully by field-to field inspection. The anna estimates shown are much lower than those given in the previous forecast, as the extent of the damage which resulted from blight could not be appreciated until a date later than that of which the forecast was issued. It will be observed that the estimates are in some cases very low indeed. Over large tracts the crop was a total failure, and there are large areas in the south of the Provinces on which the people had not even taken the trouble to cut the crop. The seed which is coming to market is thin and shrivelled, and it is probable that in some places there will be much difficulty in getting suitable seed for sowing next season. In the northern districts and in Chhattisgarh the damage was less severe, but in no part of the Provinces has the outturn been anything but a poor one A good idea of the shortness of the crop may be gathered from the fact that the exports of linseed between February 27th and April 24th have only amounted to 2¾ lakhs maunds against 7½ lakhs maunds during the corresponding period of last year.

Wheat in U. S.

The San Francisco Weekly Examiner says:—According to the Government report of March 1, there were 6,913,920 bushels, or 4 148,352 centals for home consumption, there remained only 3,175,715 centals for export. For the month of March there were exported 1,666,730 centals of which 1,484,503 centals were for Great Britain, leaving but 1,508,985 centals available for export in the months of April, May and June. It will be readily seen that if the Government figures are correct and the rate of export is continued, the stock on hand will be exhausted long before the new crop will be harvested.

In the United States values for wheat have further declined. At New York on 10th April quotations were as follows:—Spring wheat, 30s. 4d.; red wheat on spot 30s. 4d, April 30s. 3½d., May 30s. 5½d., June 30s. 8½d.; Extra State flour, 13s. 1½d. to 13s. 11½d.; mazie, 14s. 11d. per 480 lb. As compared with the rates current on the corresponding day of the preceding week these quotations show a decline of 1s. 1d. on spring wheat, 6d. on spot winter, 7½d. on April and May, and 8d. on June; 2½d. decline on flour, and 5d. decline on Mazie. The monthly report of the Department of Agriculture shows a reduction in the winter wheat area, which is less by 5 per cent. than that sown a year ago. The general average condition shows an improvement, however, being 92½ against 76 for the month of April in 1885. The visible supply of wheat, made up to April 3 stood at 48,973,000 bushels, showing a decrease of 801,000 bushels on the week; that of maize stood at 16,295,000 bushels showing an increase of 502,000 bushels on the week. The export clearances for Europe have been 71,250 qrs. of wheat, and 177,500 qrs. of maize. The ports of Konigsberg, Calmar, and Narva are now open. Of the Continent of Europe there has been but little interruption to spring sowing, and there are no complaints yet to hand with regard to the autumn sown grain and pulse crops. Markets are without any quotable change at present.

Bengal.

The Indian Tea Association estimates the outturn of the Indian tea crop of 1886 as compared with the original estimate of the crop of 1885 as follows:—

	Estimated Outturn of crop of 1886.	Estimated Outturn of crop of 1885.
	lbs	lbs
Assam ...	35,133,494	33,168,091
Cachar sylhet ...	22,908,180	19,620,413
Darjeeling, Terai and Dooars ...	13,302,800	11,422,894
Chittagong & Chota Nagpore ...	1,346,800	1,274,060
Dera Dun, Kumaon and Kangra ...	3,250,000	3,250,000
	75,941,74	68,735,458

With the exception of the North-West gardens, and a few others whose outturn has had to be estimated, the returns are those actually received from agents of gardens. The above figures point to an increased production of more than 7 million lbs. over that of last season. The consumption in India itself, and the exports to the Australian colonies and other places, may take off about 3½ million lbs. thus leaving 72½ million lbs. for shipment to the United Kingdom.

[EXTRACT.]

POULTRY FARMING

In his concluding lecture Mr. Comyns said: The subjects of to-night's lecture is one which has excited more interest and discussion than any other subject connected with poultry keeping. Poultry farming has laboured under the disadvantage of being chiefly regarded in this country as a refuge for the destitute. I can not tell the number of times that I have received applications from people of all sorts and classes as to poultry farming. The widow of the middle-class merchant, left with perhaps a few hundred pounds at her disposal; the business-man, finding the strain of city life too much for his bodily powers; the mechanic who has saved a few hundred pounds; the youth commencing life with a small capital, and having a distaste for town life—I have had applications from all

these and many others at one time or another. There seems to be a notion abroad that while almost every other profession or trade requires an apprenticeship, or at least a special education, knowledge of poultry farming comes intuitively. Every one, in fact, who desires a country life discovers that he is a born poultry farmer, and that if he does not know all that is necessary, the few missing links of information can be picked up from the editor of a poultry journal.

My first duty in dealing with my subject is to disabuse the mind of my hearers of these utterly false notions. Poultry farming, more almost than any other business, requires a special education and a personal knowledge of the details of poultry management which can not be acquired otherwise than by actual practice. No amount of mere reading can in this matter make up for the want of practical personal knowledge of details.

Another common error is that poultry farming is a sort of light occupation, suitable for a lady or an invalid or other such persons as desire freedom from the worries of a town life. No mistake could be greater than this. Poultry farming, as I once heard it well expressed, is a seven days' business. There is literally no day of rest, while at certain periods of the year there is not much rest in the night either.

The most important question I am supposed to answer is, Does poultry farming pay? As to what is poultry farming, it is usually assumed as that it means keeping poultry for table and laying purposes alone. I may at once say that poultry farms conducted on this line never have paid in this country. Many have been started, and have failed. There are, however, two other sorts of poultry farming: 1, is usually called poultry on the farm: 2, is a combination of useful and fancy, or rather pure-bred poultry keeping.

As to the poultry farming in France, there are no poultry farms proper. There are several large poultry establishments. One is M. Lemoine's, another M. Voitellier's, and a third is MM. Rouillier and Arnoult's.

There are similar establishments in this country to M. Lemoine's, the chief being Messrs. Fowler's the Huntingdonshire Poultry Farm, and the St. Leonard's Poultry Farm. Of these, the first has never been anything else but a fancy establishment, exhibition birds alone being kept. The two latter have to a certain extent gone in for a combination of laying birds with the supply of pure-bred, though not in general exhibition stock of several varieties. Each place has made a specialite of one breed; Mr. Willson, Light Brahmas, Mr. Reynvaan, Leghorns, and both have bred these varieties in great quantities, and with a special view to laying results. Mr. Willson at one time had a poultry farm proper, but he has now given it up, having taken up the supyly of houses and other poultry requisites more largely. I would say that success in poultry farming, if at all practicable, is only to be had in any degree by combining production of table and laying qualities with sale of pure-bred stock and eggs. It is very easy to make poultry farming pay on paper. This I found to be true in my own case.

Mr. Comyns here gave particulars as to his prospective balance sheet for his Brook-wood farm, and showed how they failed in practice. He then showed where the usual anticipations are erroneous: —

1. The average hen will not lay 120 eggs. At Brook-wood most laid very badly, only a few really well.

2. A number of hens together lay worse than a few do.

3. It is difficult to obtain prices quoted for new-laid eggs in large quantities. The French imports destroy the markets during the most prolific season, and it is very difficult to arrrnge private trade.

4. Difficult to obtain market for cockerels and old hens at remunerative figures.

5. Difficult to rearing a large number of chickens.

6. Danger of contagious diseases.

7. Difficulty of getting things attended to by deputy.

The following hints were given by the lecturer, how to set about successful poultry farming:—

1. Begin with small number. Be personally acquainted with all wants and with laying powers of each hen. It is easy after practice to recognise the eggs from these. It is best not to breed from pullets, but to select the best layer as pullets, and breed from them the following year. Only after several years' careful selection for laying qualities should any attempt to begin on larger number be made.

2. Go to no unavoidable expense in buildings, &c. They may look well, but are of no real value.

3. Choose a situation where soil is fairly dry and rich in natural products, such as worms, &c., suitable for poultry.

4 Choose a situation where a good market for table fowls for fattening is available.

5 Combine the sale of pure-bred stock and eggs for hatching with other business.

6. Observe rules laid down in lecture as to laying hen, having regard also in a minor degree to table qualities.

7. Allow as much space as you can, and, if possible, combine fruit growing with poultry farming. If market for milk and butter is available, some cows and a pig may also with advantage be kept.

8. Keep the birds in small numbers, and unless the ground be very rich in insect food, only let birds out on the small runs for a couple of hours each day. The runs should be 10 ft., with a dozen fowls in each, and arranged in groups of five, with a half acre run for the use of the five groups.

9. Adopt some simple plan of house.

10. Do not attempt to fatten unless you have sufficient number to make a separate branch of it.

11. Do not start at all unless you have a sufficient income from some other source to keep yourself going for our or five years and leave a margin also for loss in management, and are prepared for very hard work.—*London Agricultural Gazette.*

CALCUTTA MARKET REPORT.

Wheat.] During the first week of May, the sales amounted to about 8,600 tons. Quotations were Rs 2-9-6 for Club No 1 and Rs 2-7-9 for Club No 2. During the second week the sales aggregated to about 6,500 tons. Prices advanced about ½ anna per maund and were quoted at Rs 2-10 for Club No 1; Rs 2-8-6 for Club No 2 and Rs 2-7-3 for Shibgunj. During the 3rd week business was restricted to about 1,200 tons, consisting chiefly of hard and soft red kinds. Quotations were as follows:—No 1 Club Rs. 2-10-0. No 2 Club Rs. 2-9, Hard Red Rs. 2-5 and Soft Red Rs. 2-4-6. Upto Friday in the fourth week about 3,203 tons changed hands. Quotations were Rs. 2-10-6 for Club No 1, and Rs. 2-9 for Club No 2.

Linseed.] During the first week 3,000 tons changed hands at Rs. 4-0-6 for small grain, 5 per cent refraction and Rs. 3-12 for 15 per cent. During the second week about 3,500 tons changed hands at Rs. 4-0-6 to Rs. 4-1 for small grain, 5 per cent. refraction. During the third week 1,000 tons were reported to have been purchased by dealers. Small grain, 5 per cent. refraction, was quotedat Rs. 4-2-6 to Rs. 4-3. Upto Friday in the fourth week 1,800 tons were sold at previous rates, Quotations were Rs. 4-3-6 for small grain, 5 per cent refraction.

Rapseed.] During the third week about 1,200 tons changed hands at hardening rates. Brown Seed, 4 per cent refraction, was quoted at Rs. 3-2-6 to Rs. 3-3. Upto Friday in the fourth week a few small transactions took place in Brown Seed at Rs. 3-3.

Jute.] During the first week, nothing of importance took place; in the week following no transactions in old transpired. In new Jute business was reported to have taken place to a small extent on the basis of Rs. 22-8 per bale for marks equal to M. During the third week some further transactions in new superior marks took place. In other marks there was no business, there being a difference of Re. 1 to Rs. 1-8 between byers' and sellers' views.

Indian Tea auctions in London.] About 15,000 packages were offered and 13,400 sold during the fourth week. There was a good demand and fine qualities were 1*d* higher.

CROP AND WEATHER REPORT.

For the Week Ending 12th May, 1886.

GENERAL REMARKS.—Slight rain has again been general throughout Eastern and Central Bengal, the Madras Presidency, and the southern districts of Bombay. Heavy falls have been taken place in British Burma, Assam and Mysore. Rain has also fallen in the North-Western Punjab, at Indore and in one or two places in Rajputana.

Agricultural prospects continue unchanged in Madras. Mysore has benefited by the rain. In Croog the season is favourable.

Kharif preparations are in progress in Bombay, Berar, and Central Provinces. In Central India, Rajputana, and Hydrabad prospects are generally good.

The rabi harvest is approaching completion in the North-Western Provinces and Oudh, where ploughing for the kharif has commenced and prospects are good. In the Punjab the rabi crops are being cut, and the harvest promises well.

Agricultural operations have been faciliated in Bengal by the recent rain, but more is required in some places. Aus rice, jute, sugarcane, indigo, and cheena promise well, and the boro rice is yielding a good outturn. In Assam the weather is seasonable and prospects are generally good.

Cholera is prevalent in Raipur in the Central Provinces and is reported from several other parts of the country: but, speaking generally, the public health is good.

Prices are rising in the Punjab and are fluctuating in Mysore. Elsewhere they remain generally stationary.

For the Week Ending 19th May, 1886.

General Remarks.—Slight rain has fallen in Madras and Mysore, in parts of the Deccan and Southern Maharatta districts of the Bombay Presidency, in some districts of the Punjab and the Central Provinces, in Assam, and in some places in Rajputana and Central India. Heavy falls have taken place in Bengal, the North-Western Provinces and Oudh, and British Burma.

Agricultural prospects continue fair in Madras, in most parts of Mysore, and in Coorg.

Preparations for the kharif sowings continue in Bombay, Berar, and the Central Provinces. In Hydrabad, where the rabi harvest has commenced, prospects continue favourable.

In the North-Western Provinces and Oudh some injury has been caused to crops by hail,but prospects are on the whole good. The harvest is in progress in the Punjab, and promises well.

In Bengal agricultural operations are generally in progress, and prospects are favourable. More rain is wanted in parts of Assam.

Cholera continues severe in the Chhattisgarh District of the Central Provinces, but elsewhere the public health is generally good.

Prices are fluctuating in the North-Western Provinces and Oudh and in parts of the Punjab, and have fallen slightly in Mysore; elsewhere they remain stationary.

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TEA CULTURE IN ASSAM IN 1885.—According to the district returns, there were 941 gardens in existence at the close of 1885, against 970 at the close of 1884 This large decrease is apparent, not real, and is explained by the fact that 38 plantations were amalgamated with head gardens and shown as such in the returns, instead of separately as they had been in previous years. The only considerable decrease in area is returned from Nowgong, where four gardens were abandoned during the year, and where some extensive private surveys were made and accepted by the Chief Commissioner, resulting in a diminution in the acreage. The decided increase throughout the province as a whole is due to the new policy, now pretty generally adopted in the districts of Sylhet, Sibsagar, and Lakhimpur, of extending the area under cultivation as much as possible. The statement given below shows the figures for the last six years of the land actually under tea cultivation and also the total area held as tea grants:—

Years	Under mature plants. Acres.	Under immature plants. Acres.	Total area of land held by teaplanters. Acres.
1880 ...	120,512	33,145	566,277
1881 ...	133 293	25,134	706,649
1882 ...	156,707	22,144	783,362
1883 ...	161,707	27,746	923,664
1884 ...	158,158	31,694	913,476
1885 ...	159,876	37,634	921,891

From this table it appears that there has been a decided increase since last year, both in the area under cultivation and in the total area held by teaplanters, and it is satisfactory to note that the tea industry continues to expand in Assam, not withstanding, that the year 1884 was in many parts discouraging.

The total area returned as under cultivation is 197,510 acres, as against 186,852 shown at the close of 1884. The details according to the various districts are given below:—

District.	Total area under mature and immature plants. 1884.	1885.
Cachar	52,333	53,205
Sylhet	30,832	36,288
Khasi and Jaintia Hills ...	30	30
Goalpara	495	495
Kamrup	6,343	6,321
Darrang	16,679	18,125
Nowgong	10,854	11,606
Sibsagar	43,884	43,622
Lakhimpur	28,405	27,818
Total	189,852	197,510

The figures given by district officers for the year under report, give a total yield of 53,617,020 lbs. or an increase of 2,490,821 lbs., when compared with the returns of 1884, and 1,445,813 lbs., when compared with those of 1883. The Indian Tea Association gives the outturn at 51,225,005 lbs., or 2,393,015 lbs. less than the district officers figures. It is probable that the Association's figures

are under-estimated, owing to the want of returns from native gardens and from private gardens owned by Europeans who hava no Calcutta agents.

The following table shows the yield per acre for the Brahmaputra Valley, the Surma Valley, and the whole province respectively, according to the returns :—

	Yield per acre.	
	1884.	1885.
	lbs.	lbs.
Brahmaputra Valley	354	359
Surma	279	305
For the whole province	823	335

The Lakhimpur district stands first in order of productiveness. The Deputy Commissioner of Nowgong writes that tea-seed fe'ched a good price in his district, and that heavy consignments of it were sent to Ceylon. Notwithstanding this new market, it will be seen that the decrease in export throughout the Brahmapptra Valley since 1884 was over 60 per cent. As in previous years, the calculations of the cost of cultivation and production of different districts vary so much as to be quite untrustworthy.

The following are some of the district figures—

	Cost of cultivation per acre.			Cost of manufacture per lb.	
	Rs.	As.	P.	As.	P.
Cachar ...	67	0	0	5	0
Sylhet ...	49	7	0	8	5
Darrang ...	25	0	0	8	0
Nowgong	70	0	0	6	0
Sibsagar	95	0	0	5	9

The Deputy-Commissioner of Kumrup says the cost of cultivation varies from Rs. 22 to Rs. 140 and of manufacture from 5 to 9 annas. The Deputy-Commissioner of Lakhimpur says the returns vary so much that it is impossible to say what the costs are. There can be no doubt that the chief reason why the figures under these heads are always so unsatisfactory is because of the number of different interpretations put on the words "cultivation" and "manufacture." Another reason is that no returns are sent in or separate accounts kept by managers showing the different expenditure incurred in each phase of the production.

Railway-Borne Traffic of the United Provinces for the Quarter Ending 31st December 1885.—The exports during the quarter show an increase of more than 87 per cent. over the exports during the corresponding period of 1884. The increase occurred mostly in the exports to the ports of Calcutta and Bombay and the provinces of Bengal and Rajputana, and is chiefly accounted for by increased exports of wheat, rice, gram, and cotton. The imports stand at almost the same figures as last year. European cotton goods show a marked increase, but the decreases under other heads reduce the total gross exports by nearly a quarter lakhs maunds. The increase in the exports of wheat noticed in the previous quarter's returns continued during the quarter under report. The total quantity sent out was 25,05,352 maunds, which is considerably more than the exports during the same three months in any year since 1879. The increase occurred mostly in the exports from Meerut Division to Bombay and from Rohilkhand and Oudh to Calcutta. Among other grains the exports of rice increased by over 70 per cent. The season of 1885 especially favoured the rice cultivation; its area in the United Provinces during 1885 was more than 7 lakhs of acres in excess of the area it covered in 1884. The increase occurred mostly in the exports from Rohilkhand Division to the Punjab.

The increased export of gram to Bengal noticed in the preceding returns was sustained during the the quarter under report. Among oilseeds, linseed continued to be exported largely; tilseed showed a considerable falling off, the crop having suffered considerably from the heavy rains in the early part of 1885 season. Exports of cotton show a considerable increase compared with its exports during the corresponding quarter of 1884. The cotton crop had suffered considerably from the excessive rains both in 1884 and 1885; but the drought which occurred during the latter part of 1885 did much to improve its quality, and in many of the cotton districts, although the crop was not heavier, still it was much finer than the year 1884. The increase occurred entirely in the export to Calcutta from the Agra and Allahabad Divisions. The exports of tea to Calcutta showed a considerable expansion during the present quarter. The Commissioner of Kumaun writes: "Green tea not being saleable in Central Asia, the planters have been compelled to turn their attention to black tea and trust to the Calcutta market. Black tea is made much more quickly than green and is all ready for the market a few days after the leaf is plucked. The consequence is that the moment the rains cease and the footpaths are safe, the tea is sent off. This as well as a naturally good season during 1885, and increased cultivation in some of

the best plantations under improved methods, account for the increase in exports observed."

* * *

The exports of Indigo during the present quarter were reduced to less than half the quantity sent out during the same period last year. The excessive rains in the months of July and August, 1885, washed the colouring substance from the leaves while the plant still stood in the field. This considerably reduced the percentage of dye and induced many indigo-planters to close their factories during the year. The exports as usual were almost altogether directed to Calcutta. Among the imports the European cotton goods show a marked increase. The Ganges and Agra Canals opened for traffic in October, 1885. Their traffic during the three months amounted to 3,03,363 maunds and 72,272 maunds. Over the Ganges Canal it consisted principally in the exchange of wheat and sugar from Meerut for iron from Cawnpore and the interchange of grains and building materials among places in the Meerut Division. The traffic of the Agra Canal consisted almost entirely in the imports of gram and other grains from the Punjab into the Agra Division.

RAIL-BORNE TRADE OF BENGAL DURING THE QUARTER ENDING 31ST DECEMBER 1885.—The total weight of the external trade of Bengal with other Provinces carried both ways during the quarter aggregated 64,92,258 maunds, against 45,71,540 maunds in the corresponding period of last year, the net increase being 19,20,718 maunds, or 42·01 per cent. Under imports, there was an advance of 15,77,713 maunds, or 83·58 per cent., and under exports, of 3,43,005 maunds, or 12·79 per cent. In the Calcutta block the imports showed an enormous rise of 12,22,420 maunds, or 88·58 per cent., and the exports a small falling off, namely, 4·82 per cent. The import trade of the Behar block advanced by 3,00,085 maunds, or 73·37 per cent., and the export trade by 4,62,825 maunds, or 33·43 per cent. In the Western Bengal block, while the imports increased by 54,856 maunds, or 59·49 per cent., the exports fell by 69,758 maunds, or 28·58 per cent. The increase in the imports into Calcutta, Behar, and Western Bengal was chiefly due to large quantities of food-grains having been received from the North-Western Provinces and Oudh, and the advance under exports to large despaches of coal from Behar to the North-Western Provinces and the Central Provinces. Compared with the quarter ending the 31st December 1884, the items which exhibited a marked improvement in the import trade were wheat, gram, other food-grains, raw cotton, linseed, and poppy-seed; while in the export trade, the largest increases were under coal, undrained sugar, European cotton piece-goods, salt, and stick lac. The total weight of the internal trade of Bengal, which passed from one registration block to another within the province during the quarter, showed an increase of 6,47,684 maunds, or 5·16 per cent., as compared with the corresponding quarter of 1884.

Owing to good crops this year and to the very deficient harvest in 1884, the quantity of rice carried downwards during the quarter showed a large increase of 7,54,957 maunds. Of the total supply during the quarter, Calcutta received 7,71,471 maunds, or 92·31 per cent.; by far the largest quantity was despatched from the Western Bengal block, which sent 5,82,157 maunds, against 52,110 maunds in the corresponding quarter of the previous year. The wheat trade also showed an improvement of 1,48,126 maunds, which is due to the same cause. Raw jute rose by 70,188 maunds, the chief fluctuations in trade being an increase of 1,30,030 maunds in the supplies carried from Eastern Bengal, and a decrease of 70,978 maunds in those received from Northern Bengal. Of the total imports of this staple which aggregated 25,78,007 maunds, Calcutta, as usual, received by far the largest quantity, viz., 24,64,736 maunds, against 25,02,700 maunds. The trade in rice fell from 2,24,264 maunds to 1,37,217 maunds. The quantity imported into Behar showed a decrease of 60,293 maunds, of which the Western Bengal block is accountable for 31,087 maunds, and Calcutta for 29,206 maunds. The import trade of the Eastern Bengal block, however, rose from 27,603 maunds to 65,295 maunds, the increase in the quantity received from Northern Bengal being 62,288 maunds, against a decrease of 24,614 maunds in supplies sent from Calcutta. The short despatches from Calcutta in both these cases are indicative of better crops in the interior.

*

The traffic on the Brahmaputra and Megna rivers during the quarter shows a decrease of 17·01 per cent. under exports, as compared with the previous year. The aggregate quantity of the Brahmaputra traffic indicates a falling off of 12·95 per cent., and that carried along the Megna of 18·04 per cent. The proportion borne by the traffic imported into, and exported from, the Chittagong Division to the total trade was 51·86 per cent. The chief commodities registered during the quarter ending the 31st December 1885, as compared with the corresponding period of the previous year, are *imports*

from Assam. Lime, Canes and rattans, uncleaned Cotton, raw Jute, Oranges, husked Rice, Rice, unhusked, undressed Hides, Potatoes, Mats, Ghee, dried fish, Linseed, Mustard seed, Spices, other kinds, Stone and marble, Indian Tea, Timber, Bamboos, Treasure, *and Exports to Assam.* Coal and Coke, Piece-goods, European and Indian Piece-goods, Turmeric, Earthenware and porcelain, Cocoanuts, Fruits, Wheat, Gram, other pulses, Rice husked, Iron, Oil, kerosine Oil, other kinds, Salt, Betelnuts, Spices, other kinds, Sugar drained, Sugar undrained, and Tobacco. The increase in the aggregate quantity of goods carried along the rivers by steamers was 24·36 per cent. in comparison with the figures of the corresponding quarter of the previous year. The gross increase on the Megna route was 66·22 per cent., the advance in the import trade being 27,755 maunds, and in the export trade 27,312 maunds. On the Brahmaputra route the figures of the import trade show a very large increase of 32·87 per cent. and those of the export trade a trifling rise of ·89 per cent. Of the total traffic, 81·49 per cent. was carried to and from Calcutta. In the import trade, the articles, in which the increases during the quarter as compared with the returns of the corresponding quarter of the preceding year were most important, were jute, raw (41,304 maunds), lime (25,872 maunds), mustard seed (22,679 maunds), and lac (8,155 maunds); while the largest falling off occurred under tea seed (6,950 maunds,) and tea Indian (957 maunds). As regards the export traffic, the chief articles which showed an increase were gram and pulses (42,890 maunds), rice husked (13,892 maunds), oils mineral (9,610 maunds), iron (4,116 maunds), liquors (Rs. 77,176), wool manufactured and European (Rs. 7,635), earthenware and porcelain (Rs. 4,533), and the principal items which exhibited a decrease were coal and coke (32,259 maunds), other metals (3,616 maunds), cotton piece-goods, (European Rs. 3,45,989), leather manufactured (Rs. 12,677), gunny-bags (5,034 in number) and blankets (3,137 number).

Raniganj Pottery Works.—These works are situated close to the Raniganj Station, East Indian Railway, 120 miles north of Calcutta, and are the property of Messrs. Burn and Company, of Calcutta, who commenced working them in 1870. They occupy about 40 bighas of land, and cost about eight lakhs of rupees. In the construction of works of this description, very heavy outlay is entailed, especially by the large area that has to be covered with spacious buildings required as drying-sheds for the green pipes, each pipe after leaving the mills having to be kept for 14 days in the dry season, and for about 35 days in the rainy season, before it is in a condition to pass out to the kilns. In this instance, about 5 bighas of ground are covered by these drying-sheds, and, in addition, there are flushed sheds for artificial drying when time is limited, machinery-sheds, washing and sorting sheds, store-houses, engine and boiler houses, office and other buildings, of which it is unnecessary to give the details, and numerous kilns of various description. The machinery consists, principally, of pipe-mills, crushing-mills, grinding-mills, stone-breakers, throwing-tables, tile presses, cotters' wheels, pug-mills, wash-mills, glazing-mills, and other applicances. It is actuated by stationary high pressure engines, equal to 120 horse-power, five boilers, and two steam-pumps. The annual consumption of coal is about 200,000 maunds. The water-supply, which is laid throughout the place, is derived from a 12 ft. well 90 ft. deep, sunk into the solid rock with a 4 inch bore-hole carried 60 ft. deeper, and from a large tank about 14 ft. deep with a superficial area of about 14 bighas; so that there is never any deficiency of water even in the driest season. In connection with the water-supply, there is a complete system of underground pipes to carry the drainage and the rainfall off. The works are connected throughout and with the East Indian Railway, by a metre gauge tramway measuring over all nearly two miles long.

* * *

The principal productions of the works are glazed stone-were drainage pipes, which are also largely used for wells, and for culverts—whether single or in groups—under roads and railways, with great success; fire-bricks, roofing-tiles, and tesselated pavements. The varieties of minor productions, whether ornamental or useful, are countless. Stocks of these productions are always kept on hand to the value of from Rs. 2,00,000 to Rs. 3 00,000, so as to be ready to meet any demands that may be made on them. One of the principal industries just at present seems to be a special kind of cheap filter, for which the demand is evidently in excess of the outturn. The number of people employed in this industry varies from something under 1,000 to something over 1,200, according to the season of the year. We were sorry to hear that the competition of the cheap and inferior drainage-pipes imported from Europe is so great, that the return for the outlay on this enterprise is not what it ought to be and that a fair remuneration connot be obtained, except by considerable extensions of the works, so as to reduce

the proportion of establishment to outturn. This, however, has hitherto been denied to it, as the only possible expansion that the works could take would be over the land occupied by the sub-divisional officer's house and compound; but we are told that there is some prospect of this restriction being removed, as his Honor the Lieutenant-Governor, who lately visited the works, and the Commissioner of the Division are both taking an interest in the matter and negociations are in hand for a transfer of the officer's house to another site at Messrs. Burn and Co's expense. It seems a pity that the advance of a new and useful industry like this should have been a checked by a cause which appears to have been so easily removable. These works are being well represented by numerous specimens of their prductions at the Indo-Colonial Exhibition in London. They were awarded several gold medals and the highest class certificates at the Calcutta International Exhibition.—*The Indian Engineer.*

VETERINARY COLLEGE FOR BENGAL.—It is not a moment too soon that the Bengal Government has matured the plan of opening a veterinary college for this province. The proposal had been simmering for sometime and only recently it has boiled over. The scheme as recommended by the Committee appointed in January 1883, and since then modified to meet the financial difficulties of the present time, by Mr. Finucane, the Director of the Agricultural Department in Bengal, has recently received the general approval of His Honor, the Lieutenant Governor. Reports of severe outbreaks of cattle-disease from various parts of these Provinces have for many years back reached the Government of Bengal, and the question of preventing or mitigating these visitations has from time to time received attention. The question was brought into special prominence in 1868-69, when a Commission was appointed by the Supreme Government to enquire generally into Indian cattle plagues and to report on the measures which might be adopted to check their ravages. The Commissioners, in their report submitted in 1871, suggested various precautions to prevent the spread of disease on the appearance of epidemics, but laid particular stress on the need of a skilled agency for the special object of imparting instruction in veterinary science, and training a class of natives for service among the people, whether as Government officers or private practitioners. Arising out of discussions connected with a virulent outbreak of cattle disease in Chota Nagpore in 1878, a proposal was made by the local officers for the establishment of a veterinary class in connection with the Medical College in Calcutta for the purpose of training Sub-Assistant Surgeons and Native Doctors in veterinary practice. The Medical College authorities, having been consulted on the subject, expressed themselves strongly impressed with the necessity for the establishment of a veterinary college, but were opposed to the proposal to mix up medical with veterinary training. Enquiry was made at that time of the Government of India whether there was any prospect of the establishment of a separate veterinary college in Calcutta, and it was ascertained that there was no immediate prospect of any such college being established. Sir George Campbell accordingly allowed the matter to drop. In 1882 Her Majesty's Secretary of State, called the attention of the Government of India to the subject of the great prevalence of cattle-disease in India and the great loss which i. caused and pointed out that "there is none which deserves the earlier or more careful consideration of the Agricultural Departments then being organised in accordance with the recommendation of the Famine Commission." Lord Hartington desired to be informed, after such reference to Local Governments as might be deemed requisite, what steps had been taken, and what steps it was proposed to take, to give effect to the recommendation of Commission of 1869.

Mr Finucane's proposals were that the school be opened at Bhagulpore, that the maximum limit of annual expenditure be fixed at Rs 25,000, that instruction on agriculture and surveying be added to the course of instruction, that attention be also given to the question of breeding and improvement of cattle, that the number stipends be fixed at 30 instead of 60, and that the holders of these stipends be at first guaranteed employment on completion of their college course under private landholders and local bodies and, failing that, under Government on estates under its management. The Bengal Government has disallowed the proposal made for including agriculture and surveying in the course of study. "From on educational point of view" these subjects may not be connected with the veterinary art but from a practical pointed of view, agriculture and surveying are subjects not quite so unconnected with veterinary science as they might seem at first sight. The usefulness of the institution will greatly suffer if the science and practice of veterinary medicine be not taught with special reference to the treatment and cure and, also if possible, to the improvement of the indigenous breeds of agricultural cattle. We have seen that the very best men of the Royal College of Veterinary

Surgeons in London, however strong they might be in the treatment and cure of horses, show a lamentable amount of ignorance as cow-doctors. We should not like to see the passed students of our new veterinary institution show the same amount of ignorance of the diseases of cow and their cure. The treatment of horses may be combined with that of cattle but the latter should have all the pre-eminence it deserves. Ours is an exclusively agricultural country and cattle the main stay of our agricultural population. A veterinary collge to be of any use to the agricultural community should have its attention directed more towards the treatment and cure of agricultural cattle than horses. The inclusion therefore of agriculture in the course of instruction prescribed for the proposed college was a very wise step on the part of Mr. Finucane and we are sorry to see that it failed to meet the sanction of the Government. It may however be led to reconsider the sanction and provide for agricultural education in the institution as proposed by Mr. Finucane, when the college will be stablished next season.

The Superintendent of the College ought to be a specially qualified man having good deal of practical experience in the treatment and care of cattle of India and the provision of Rs. 900 as salary for this post has been very wisely made. With other qualifications, he should also have a certain amount of administrative ability, the latter being absolutely necessary for one to be placed in the head of an institution, the creation of which lies almost entirely in his hands. We hope that Lieutenant Steel of the Madras Veterinary Department who has been strongly recommended for this post, combines in him all the necessary qualifications. He will however have one very great difficulty in lecturing to Indian youths. To teach Indian youths of the class who will enter the school, it is absolutely necessary that the superintendent should be well versed in the vernacular or vernaculars of the province. But we are afraid, the want of this knowledge will be a great draw-back in his case. As regards the post of the Assistant Superintendent to be filled up by a Cirencester graduate, the salary seems to have been fixed at too low a figure. The initial pay ought to have been fixed at Rs. 300 at least with distinct pro pect of his being made superintendent when he will have acquired sufficient experience under the superintendent. Besides he will have the great advantage of addressing the students in their own vernacular. Practically all the work of teaching will fall on the Assistant Superintendent, who shall have to render the lectures in vernacular before this can be intelligible to the students and, if he be a Cirencester graduate, he will soon pick up the necessary experience for being the Superintendent of the Institution. Without this prospect before him, and the initial pay raised to Rs. 300 at least, it will be difficult for the Government to find a Cirencester man to fill up the post. The most distinguished amongst them had formerly held Government service in the Education Department with a monthly salary of Rs. 150 to Rs. 250, and had they never gone to England would surely by this time have been in the enjoyment of higher salary still. Their going to England, if it has done nothing, has not certainly disqualified them for better appointment carrying higher salary in the eyes of the Government. The undeserved neglect with which they have been treated by the Government has brought down the name of the agricultural scholarship almost into the category of a by-word. The Government owes it to themselves as well as to the scholars whom they had sent and are still sending to England, to suitably recognize their claims; otherwise instead of throwing public money on them any more, the same may be utilised for a much better purpose.

* * *

In conclusion we may profitably quote what Mr Finucane has to say about the necessity and usefulness of an institution of the kind. "Private landoweners have often been blamed for having hitherto failed to make any attempt to improve the breed of cattle in Bengal, or to stay the deterioration of existing breeds. But it would seem that it is hardly open to Government or its officers to reproach others for *laches* of this kind, when Government has itself done so little in the vast areas under its own immediate control and management. There prevails, I have been assured in the course of my tours, a strong and general feeling among zemindars, European planters, and other classes, that it is necessary to do something towards the improvement of the breed of cattle in Bengal and Behar. Nobody who has observed the rapid appropriation of village pastures for cultivation, in Behar especially in recent years; the destruction of old mango groves without plantation of young trees; the miserable condition of the emaciated cattle seen languidly nibbling stunted tufts of grass in the parched lands of that part of the country, during certain months of the year, will be disposed to deny that it is very desirable to do something, if we only knew what to do. The question is, however, one of extreme difficulty. In districts like Durbhunga, Muzufferpur,

Sarun and Patna, with a population almost entirely agricultural, of nearly 900 to the square mile, hard pressed for the means of subsistence, and with great consequent competition for land, it is almost impossible to check the appropriation of village pastures for cultivation, or the destruction of groves for the provision of timber and fuel. The result is that there is not at present sufficient supply of food for cattle, and the supply of fodder is yearly becoming less and less. The question of adding to the supply of food, which is closely connected with the question of preventing mortality, and is a necessary antecedent to the question of improving the quality of existing stocks, is, however, one of so much difficulty that it cannot be dealt with here, and can scarcely be regarded at best without a feeling of despair. This much may however be said that if anything is to be done in the direction of improving the cattle of these provinces, the first thing necessary is to acquire information as to what breeds can be usefully introduced or crossed with existing breeds. This information is not at present available in Bengal, nor, as far as I know, is there any person in these provinces who is competent to give such advice on the question as might be safely acted upon. An expert, such as the Superintendent of the proposed veterinary school should be, would soon be able to give valuable and trustworthy advice to Government on these questions, and there would not, I conceive, be very great difficulty in acting on such advice, in khas mehals at least, if Government could only feel assured of its soundness." Similar attempts had formerly been made in different parts of the province and it came out in the Bahrapur Agricultural show that the effects of an attempt made sometime ago in Patna by the then collector of the district have not been entirely obliteratead, though with the lapse of time and for want of continuity of action, they are fast disappearing. We might therefore add that the suggestions made by Mr Finucane as to improvement of breeds of indigenous cattle, should the Government decide to act upon them, will have to be supplemented by a further suggestion that means should at the same time be taken to keep up continuity of action, for want of which public money was many times wasted in past with further chance of being wasted in future.

Stock Breeding Farm In Madras.—The late Director of Revenue Settlement, Madars, put forward a scheme for a stock-breeding farm that was approved by the Government on 16th January 1886. The Madras Government observes in an order:—'The object of this is (with the exception of a few experiments in crossing the various breeds), not to breed stock, but to collect and rear bulls, which, when fit, will be distributed in localities where it is deemed desirable to attempt an improvement in the breed of cattle. In carrying out this plan, the chief point to be kept in view should be the improvement of stock in those parts of the country where, from various causes, the cattle have degenerated in connection with both draught and dairy purposes." In a country were milk and butter enter so largely into the diet of the people, it would be clearly a mistake, the Government consider, to lay aside, as Mr. Glenny, the Acting Director seems disposed to do, all idea of improving dairy stock. There are some districts, for example, Nellore and parts of Salem, where there is already, as far as draught is concerned, a very good breed of cattle. It would be a mistake to say that fresh blood, judiciously selected, would not be of advantage even here; but there are other localities which more urgently demand attention, and in fixing on a central depot, regard should be had *inter alia*, to its not being too far from the places where the services of the bull will be most required. The indigenous cattle in Trichinopoly, Tanjore, South Arcot, and parts of Salem and Coimbatore are deficient as draught animals in size and bone. As regards the Aden herd, the Government are of opinion that they should be kept at the central depot, as soon as one is selected. Two bulls fit for service might, however, be sent to Punganur, and the Government consider that they could not be better located than with the Punganur Zemindar, who would, it is presumed, gladly embrace the opportunity of improving the stock on his estate. The director has been instructed to place himself in communication with that gentleman on the subject.

*

Trade of India.—During twelve months ending 31st March 1886, the total amount of merchandize imported was worth Rs. 55,65,19,552 and the total amount of treasure imported worth Rs. 15,46,70,808, while that of merchandise exported was Rs. 83,86,11,693 and treasure exported Rs. 1,10 82 310. The gross amount of import duty collected including salt was Rs. 2,25,61,988 and export duty Rs. 74,38,495. The articles on which import duties are charged are arms and ammunitions etc., (excluding military accoutrements), liquors such as ale, beer, spirit, etc., opium, salt; and the one on which export duty is collected is rice both husked and unhusked. The most noticeable feature among imports is the increase of raw materials and

unmanufactured articles to the amount of Rs. 20,08,128 and among exports the decrease under the same head to the amount of Rs. 3,32,53,816 of which Rs. 2,50,91,632 were in raw cotton alone and the rest distributed over borax, caoutchouc, coir, feathers, jute, mowa or merwa flowers, saltpetre, earthnuts, mustard, poppy, rape, til, and silk. With reference to the export of mowah flowers it is to be remarked that in 1883-84, the total value of flowers exported was Rs.6,70,664; in 1884-85 Rs. 60,917 while during last year it fell to Rs. 2 only. The sudden increase in the export trade of this article and the equally sudden fall off deserves more than a passing notice. Mowah plant (Basia latifolia) is very common in Upper Bengal and along with *sal* (Shora robusta) gives a peculiar feature to its flora. By distilling the flowers with water a kind of country-spirit is obtained, which is a favourite beverage with the common class of people of this country. The sudden fall off of export in this article may either be due to its increased consumption in this country brought on by the outstill system leaving no margin for foreign exports or, which is more likely, the foreign exporters found out that the spirit distilled out of them has not the requisite flavour to suit European taste. In those parts in which it is indigenous, mowa is valued both for its flower and seeds, from the latter of which a kind of thick, whitish yellow turbid oil is extracted which is used by the lower class of people under the name of *konchra* and also for adulterating *ghee*. In these dys of universal commercial depression, the dealers in raw materials of India should do well to develope the trade in this article. It will interest our readers to know that during last year, we imported soaps worth Rs. 8,82,042; umbrellas Rs. 18,43,879; toys Rs. 11,35,576, matches Rs. 19,61,560, candles Rs. 9,42,717, clocks and watches Rs. 10,98,566 paper Rs. 32,79,733, perfumery Rs. 5,57,111, books and printed paper Rs. 16 39 741, and agricultural implements Rs. 4,14,076. Consumption of soaps increased during the year by Rs. 1,37,694. Our appetite for this article of luxury seems to have received a sudden impetus during the year under review.

1. Memorandum on the Prospects of the Wheat Crop in the Punjab: From Government of India.
2. Memorandum on the Prospects of Wheat crop in Berar for 1885-86. From Government of India.
4. Report on the Cownpore Experimental Station for the Rabi Season 1884-85: From Director Department of Agriculture Commerce N.-W. Provinces and Oudh.
5. Report of the Agri-Horticultural Society of India for May 1886: From the Secretary.
6. Journal of the Madras Agricultural Students, Association for February 1886: From the Association.
7. Memorandum on the Wheat Harvest of 1885-86 with Appendix: From Govt. of India.
8. Journal of the Agri-Horticultural Society of India, Vol. VII: From the Secretary.
9. Report of the Rail-borne Traffic of Bengal during the quarter ending 31st December 1885: From Govt. of India.
10. Report of the Rail-borne Traffic of the North-Western Provinces and Oudh during the quarter ending 31st December 1885. From N.-W. P. and Oudh Govt.

Thanks of the editor are recorded for all the above contributions.

SIR,

If I mistake not a few days ago I had read in the issue of the Indian Agriculturist of the 29th Ultimo a subject both interesting and beneficial to me and all large landholders. I therefore avail myself of the opportunity and request you to publish this in your valued and wide spread journal. That correspondent treats the subject of Mowa flowers; I herefore beg to state that I possess about 3500 acres of wasteland in Punch-Mahals where you might be well knowing that Mowda trees grow luxuriantly and have pleasure to say that thousands of such trees stand on my estate. Hence from my own experience I can positively say that these flowers are beneficial to give to cattles as a stimulent and tonic in winter and more especially with grains, but if given in warm weather it will on the contrary do immense harm. Really these flowers are much pleasant to the taste; but it is a fact that they are alcoholic. However, poor wild people use them as food. He further says the average yield of such flowers from a single tree is 15 maunds, but I say such is not the case. I have got such large trees that even the oldest man on this side don't know the year of their growth; but they generally believe that they might be more than a century old I therefore now leave it entirely with the public to judge whether 15 maunds of Rs. 40 tolahs can be the average yield when such large trees exceptionally yield such a good outturn.

Rustunpore, 23-6-86.

Samanjee-a-Dalal.

WHEAT IN INDIA.

THE principal wheat-growing tracts of India are the Punjab, the United Provinces, the Central Provinces, Bombay, and Berar which taken together comprise nearly three quarters of the total area of wheat cultivation in India, the remaining one-quarter being in Behar (Bengal), and in the States of Native Princes.

The total acreage under wheat cultivation in the first named tracts during the season that is just over was about 20 millions (19,878,742) of which fully 30 per cent. was in the Punjab, nearly 28 per cent. in the United Kingdom, 21 per cent. in the Central Provinces, nearly 16 per cent. in Bombay and 5 per cent. in Berar. The total outturn for the above acreage has been estimated at 6,317 115 tons which gives 6·3 cwts or 10·8 bushels* as the yield per acre.

Taking each province separately, the yield per acre as compared with the year 1884-85 is as follows:—

	1884-85 cwts	1885-86 cwts
United Provinces	8·0 ...	7·0
Punjab	7·7 ...	7·7
Central Provinces	5 1 ...	4·4
Berar	2·5 ...	2·8
Bombay (including Baroda &c.)	5·6 ...	5·4

From the above table it is evident that the yield per acre fell off during 1885 in all the chief wheat-growing provinces excepting the Punjab and Berar.

The division now usually adopted of the varieties of Indian wheat is into red and white, each of which is further sub-divided into hard and soft. In the Punjab the wheat most commonly grown is the soft red which requires less irrigation and less manure than the more valuable soft white variety. In a resolution recorded by the Government of the Punjab on the 19th March last, it was estimated that soft red wheat was grown on 5 millions of acres out of a total of 7 millions of acres under cultivation in the Province. In the United Provinces the varieties grown are red on about 2 millions of acres, red and white mixed on 2 millions, and white on 1¼ millions of which over a third is grown in the Meerut Division. In the Central Provinces the classes of wheat in principal demand are the soft white variety known as *pissi* and the hard red. Soft and hard wheats are grown in nearly equal proportions. Before the expansion of the wheat trade, *pissi* was an inferior variety of soft wheat grown on a limited area. The demand for soft wheat for export has brought it to the front rank and it now occupies a very large area. This furnishes powerful evidence of the readiness of the Indian cultivator to adapt himself to a change of circumstances. In the Bombay Presidency the varieties chiefly grown are hard white in the Deccan, soft red in the neighbourhood of Ahmedabad, and soft white, both red and white, in Sindh.

The cost of wheat production varies in every locality, but even for the same locality the total cost can very seldom be made out. The difficulty is due to the impossibility of assigning an accurate money value to the operations like ploughing, sowing, etc which in India are generally carried out by the cultivator and his family and not by hired labor. Manure again such as dung heaps, old and broken down mud-walls, etc, can hardly be valued, there being no data to proceed upon. Two estimates however given a few years ago as the average cost of raising an acre of irrigated wheat in the North-Western Provinces by experienced officers of the local Agricultural Department will give the readers some idea of the probable cost of wheat cultivation in one of the chief wheat-growing provinces of India.

I

	Rs.	As.	P.
Ploughing (8 times) and harrowing ...	6	0	0
Seed (100 lbs)	3	0	0
Sowing	1	0	0
Canal dues	1	8	0
Labor	4	0	0
Weeding	0	12	0
Reaping	2	0	0
Threshing and cleaning	3	12	0
Rent of land	8	0	0
Manure (3½ tons)	3	0	0
Total ...	33	0	

II

	Rs.	As.	P.
Ploughing (8 times)	6	0	0
Clod crushing (4 times)	0	8	0
Seed (100 lbs)	3	0	0
Sowing	0	14	0
Weeding	0	12	0
Reaping	1	8	0
Threshing	3	8	0
Cleaning	0	6	0
Irrigation (3 times) and making water bed	0	3	0
Canal due	1	8	0
Labor	3	12	0
Manure (100 mds)	3	0	0
Rent (2nd class land)	7	0	0
Total ...	31	7	0

* 65 lbs. of wheat go to a bushel.

The average yield of an acre of wheat in the North Western Provinces is 8 cwts or about 11 mds 8 seers and taking the total cost of wheat production to be Rs. 30 per acre, the cost of producing a maund comes to Rs. 2-10-10. The cost of producing a maund of wheat in the Central Provinces has however been estimated roughly at about Re. 1-2. This shows within what wide limits the cost of production varies in different provinces.

The trade in wheat is no less interesting than its cultivation, both from the Indian as well as the English point of view. The exports by *land* during the year 1884-85 were 387,307 tons from the Punjab, 135,688 tons from the United Provinces, 349,688 tons from the Central Provinces and 19,709 tons from Berar. The export from the United Provinces are mostly consigned to Calcutta, and those from the Central Provinces and Berar almost entirely to Bombay, the rates of freight deciding the destination of the consignment. Compared with the two previous years, the wheat trade was comparatively dull in the North-Western Provinces but showed a very rapid increase both in the Punjab and the Central Provinces. The circumstances of the Punjab and Central Provinces as wheat-growing tracts, differ considerably. In the former Province wheat is grown chiefly for home-consumption, the surplus only, about one-eighth of the total out-turn, being exported; whereas in the Central Provinces the export trade gives the chief impetus to wheat cultivation and not more than half the crop raised is consumed locally. Besides rains seldom fail in the latter while in the former unprotected lands are liable to failure from drought. The average price of wheat in different districts or blocks of the Central Provinces varies widely and the variations have been shown to bear close relation to the distances of those districts from the nearest railway Station. The wheat trade of these tracts may therefore be expected to develope with the extention of the railway system.

The three chief exporting ports are Bombay, Karachi and Calcutta. Besides local supply, the consignments to the first named port come principally from the Central Provinces, to the second from the Punjab and to the third from the United Provinces. The total quantity of wheat exported during last year amounted to 1,053,025 tons, the highest figure on record, of which 530 434 tons were exported from Bombay, 312,051 tons from Karachi, 209,483 tons from Calcutta, and the remaining few tons from Madras and Rangoon. In other words, while Calcutta exported 19·89 per cent. and Karachi 29·63 per cent., Bombay exported 50·37 per cent. These figures show that Bombay is the main outlet for Indian wheat, and that while the export trade which takes place by way of Karachi has rapidly increased from 19·81 per cent. in 1882-83 to 29·63 per cent. in 1885-86, the export trade by way of Calcutta is rapidly falling off (from 31·38 per. cent in 1882-83 to 19·89 per cent. in 1885-86.) Of the foreign countries importing Indian wheat, the United Kingdom takes the first place. During last year, the latter country imported 57·81 per cent. of the total quantity of wheat exported from India, Belgium, France Holland, Italy, Egypt and other countries absorbing the remainder. This statement brings out prominently the close relation which has grown between the Indian grower and the English consumer and all facts bearing on it should in the interest of both be carefully studied.

The harvests in England, in Russia and in the United States largely rule the export trade of Indian wheat. In 1883-84, the harvests were abundant in the United States and in Russia and the imports from India into England the year following amounted to only 400 495 tons, against 562,174 tons in the previous year; whereas in 1884-85, the harvests in both the countries named above were deficient and those of India yielded a fair average out-turn; the natural result was that in the year following (1885-86) India exported to England 605,098 tons. Our competitors in the English market are the United States and Russia and it behoves us and our Government to note carefully from year to year the condition of harvest in the United Kingdom, the United States and Russia which for the year 1885-86 is reported to be in the main favourable, so that, so far as can at present be foreseen, no exceptional demand for Indian wheat during the current year is probable.

Bombay as we have shown above is the principal outlet for the export of Indian wheat. The transactions in the consignments of wheat to Bombay and export therefrom usually take place between the months of January and June every year. During 1885 the fourth week of January, the second, third, fourth and fifth weeks of May brought by far the largest consignments to Bombay, the period of maximum arrival being the week of May ending 30th instant. In the previous year the average consignments were not near so large as in 1885, and the period of maximum was the week ending the 6th May. Similarly the exports from Bombay during the year under notice from January to June were considerably larger than in the previous year, the period of maximum being the week of May ending 23rd instant; and the 4th week of January, 1st week of April, and 1st week of May falling not much behind the period of maximum, although in the year previous the maximum

quantity exported during the week ending 13th June was greater than that of any week during the last year. Exports from India to Great Britain reached its highest limit in the 4th week of May ending 23rd instant.

The average price of Indian wheat was as usual very variable during the year, No. I *pissi* from a little over Rs. 25 to a little over Rs. 30, *laskari* from little over Rs. 20 to about Rs. 24, *katha* from Rs. 19 to Rs. 22, and soft red from Rs. 24 to a little over Rs. 26 per candy. The average price per quarter in London varied from 36*s*. to 39*s*. (a quarter being about 3mds and 8 seers). This was considerably higher than the average price during the preceding year. Freights to Liverpool or to London were also much lower. The former was as low as 16*s*. 6*d*. per ton in April and the latter 16*s*. 6*d*. per ton. The former however rose to 24*s*. in June and the latter to 23*s*. in May which with short intervals continued through June. The average price of wheat per quarter in London being higher than in the preceding year and the freight lower, both very material to Indian export, larger quantities were exported during the last year than in the previous one, though exchange was slightly against it. Exchange in sight varied from 1*s* 7$\frac{5}{8}$*d* in January to 1*s* 7$\frac{15}{16}$*d* in the 4th week of May; while in the preceding year exchange touched as low as 1*s* 6$\frac{7}{8}$*d* and did not rise higher than 1*s* 7$\frac{3}{8}$*d*. The chief factors therefore which determine the export of Indian wheat to England, are harvest at home as well as in England, in the United States and in Russia, freights to Liverpool and London, and rate of exchange.

THE CULTIVATION OF SUGARCANE AND PREPARATION OF SUGAR.

IN POONA DISTRICT,

With suggestions for its improvement.

Sugarcane has been cultivated and the sugar extracted from the cane in this district from prehistoric times.

The form in which it is chiefly prepared is, an intimate mixture of crystalline and colloid sugar locally called Gool.

Crystalline sugar is locally called *Sakar* and a mixture of dissolved crystalline, and colloid sugar is called *Kakwe*.

The term *Kakwe* appears to be exactly synonymous with molasses, as it includes crystalline sugar dissolved in water, in English called Syrup and the inverted or uncrystallizable sugar called Treacle.

SOIL.] Sugarcane culture is not confined to any particular class of soil. Land that experience has proved capable of growing fair crops of the common cereals of this country, Jowaree (Sorghu vulgare) and Bajree (Penicillaria Spicata) or Whea (Triticum aestivum) will, when irrigated and manured, in the climate of this district, yield heavy crops of sugarcane, if not liable to be heavily flooded.

Such soils in this district are—

(*a*) A sedentary soil, forming a rough, sandy loam overlaying trap rock in a disintegrated state locally called 'moorum.' This soil is seldom more than one foot deep, the underlaying moorum varies from 1 to 10 feet and beneath is more or less soiled trap. Such soil is generally poor but with irrigation and abundant manure bears heavy crops of sugarcane for a few years after it is brought under irrigation.

(*b*) A black clay loam also formed from the trap but evidently of much greater age than the first mentioned soil. This soil has abundant limestone nodules, it is often of great depth, and as the body of the soil has its particles in an extremely fine state of division, it has great power of retaining water, of absorbing moisture from the atmosphere, and of fixing the volatile part of manure, therefore it is justly considered a very fertile soil.

(*c*) In the few instances in this district in which alluvial soil is not liable to be heavily flooded the land produces excellent crops of sugarcane. The watershed of the rivers being trap hills, this soil combines the properties of the preceding two classes.

PREPARATION OF THE SOIL.

Soon after the Monsoon crop is gathered, about the beginning of November manure is led on, in quantity varying from 10 tons of the rich poudrette prepared by the Poona municipality by mixing 2 parts of fresh human excrement with 1 part of dry ashes obtained by burning city garbage, costing Rs. 8 per ton or 20 tons per acre of cowdung at Rs. 5 per ton, or 40 tons per acre of town sweepings applied without any preparation whatever costing Rs 2 per ton.

The latter is a recently adopted practice with much to recommend it for sugarcane culture, because the decomposition, of the manure can take place in the soil, and there is little loss of ammonia

No doubt this practice would not be advisable for many crops But for sugarcane under irrigation practically it gives excellent results and theoretically is quite unexceptional.

Sir J. Lawes, the great Agricultural experimentist, says on this point. "It is very easy to look at a manure heap with a view to doing something to it, but you cannot do much without running into expense and it is doubtful whether the cost of turning the heap (to induce regular fermentation) will be recouped by the effect produced on the soil."

In this instance Lawes questions the utility of a long cherished idea of the British and of the Indian cultivator that manure should be well fermented before it is used.

The irregular and unhealthy growth produced by fresh manure in dry soil may easily be observed but with sugarcane under irrigation, when the manure consists of town sweepings, it certainly ought to be put into the ground as fresh as possible, because but a small proportion of the manure is available for immediate effect. The water prevents the acrid portion from being injurious and the undecomposed part of the manure has plenty of time to become fit for use, and the ammonia which would have gone off into the air from a dry manure heap becomes fixed in the soil.

Should Bones be used for Manures ?

To answer this question intelligently, it is necessary first to consider what manure is. The Indian cultivator knows that manure is something which, if added to the soil under conditions of moisture which experience has taught him to be necessary, produces fertility. But science gives us something more definite. Science shows us that the soil consists of certain ingredients, some of which are present in large proportion, while others are found in very small proportion. Again, some of the ingredients are soluble in water, others are insoluble. Science shows us with indisputable proofs that the soluble portion of the soil is the more important for fertility, but like many other important bodies it would be of no avail without the assistance of the insoluble portion which acts as a body and keeps the plant and the soluble part of the soil in contact.

Of the ingredients of the soil that are present in least proportion, it is remarkable that plants take up comparatively a large quantity and, as what is soluble in water only is taken up, the part of the soil on which plants feed is very limited.

A great number of careful observations made by fully qualified men, shows us, that, of the ingredients that are scarce in soils generally, Phosphoric Acid, Nitrogen, and Potash are taken up by crops in large quantity, therefore if those ingredients are supplied to an ordinary soil fertility is the result. This is an indisputable fact. The discovery is the work of a great number of men working independently, each adding a little truth, until the matter has grown out of the theory stage and is now an established axiom.

Admitting this, then it is plain that Phosphoric Acid, Nitrogen, and Potash have the chief right to the name manure.

How much of those ingredients are found in good farmyard manure, which is at least equal to the best manure used by the Indian cultivator ?

In Mc'Conn ell's Agricultural Note Book which is compiled from best authorities it is stated that

One ton of Farmyard manure contains—

9 to 15 lbs. Nitrogen
9 to 15 " Potash
4 to 9 " Phosphoric Acid

One ton of Raw Bones contains—

Nearly 500 lbs. Phosphoric Acid
" 100 " Nitrogen

The Nitrogen is variable because it partly becomes volatile and goes away as Ammonia.

Potash is usually more abundant in our soils than the other scarce ingredients and the habit of the Indian cultivator of manuring with ashes keeps the supply up to a sufficient standard.

This comparison of the proportion that occurs of what we must call *true* manure in bones and in the ordinary manure available, proves that if bones are procurable for Rs 20 per ton the manure is immensely cheaper than garbage at Re 1 per ton.

The chief difficulty lies in the Phosphoric Acid being combined with Lime so as to form a compound insoluble in water. This may be overcome by crushing the bones and bringing the juices in contact with an acid. Perhaps Carbonic Acid obtained from decomposing stable litter and other refuse will be the most easily procurable in this country.

Professor S. Cooke of Poona has patented a process in which wood ashes and quicklime are the agents employed to dissolve the bones.

At the College of Science Farm Poona, the carbonic acid process is carried on as follows. The bones are crushed in a mill which will not permit pieces larger than 1 inch diameter to pass. The crushed bones are mixed with dung in equal parts and buried in a pit, after a few months the bones are found to be soft and fit for manure.

THE BONE MILL.]—Bones while fresh are very tough and difficult to crush but mills specially

adapted for the work are plentiful in the market. Unfortunately those machines are more complicated than is desirable for use by peasantry. A bone mill that would be nearly as simple as a sugarcane mill that would work by bullocks with as little gearing as possible, is still much wanted and would surely make a small fortune for the clever mechanician who produces it. The speed at which sugarcane mill is worked seems well suited for bone crushing.

Here is a grand field of usefulness for Agricultural Societies. A few strong Bone Mills mounted on wheels could be sent about the country stopping at the villages and crushing the bones collected by the low caste people. After being fermented in a pit, the nature of the crushed bone is completely changed and the Hindoo cultivator will use it as freely as he uses poudrette at present.

FISH MANURE.]—Small dried salt water fish are brought from the coast as manure for sugarcane. This is nearly the same as the Fish Guano of Europe. A dressing of 5 cwt. per acre of this manure has been found to give most gratifying results on a crop of sugarcane. The cost of this manure delivered near Poona is about Rs. 38-8-0 per ton. This at first sight appears a high figure but when compared with cowdung manure at Rs. 5 per ton, it will be found very reasonable.

	One ton of dried fish. yields nearly	One ton of dung yields nearly
Phosphoric acid	360 lbs.	6 lbs.
Nitrogen	88 „	12 „
Potash	6 „	10 „

The fish does not require grinding or any other preparation and is decidedly cheaper than dung at Rs. 5 per ton.

In buying fish manure a sample free from sand should be selected.

The salt which accompanies saltwater fish has not been observed to do injury in this district, probably because the proportion of salt in the soil here is very low.

It is well known that common salt and other chlorides form uncrystallisable compounds with sugar. It is stated in the Encyclopœdia Britanica that salt combines with 6½ times its weight of sugar forming an uncrystallisable compound and that much loss is to be attributed to this cause.

FOLDING SHEEP on the ground with a view to manure being obtained is well known among the cultivators of this district and is much practised at a distance from other sources of manure.

GREEN MANURING] The use of green crops as manure is well understood but no green crop is considered fit to give sufficient manure by itself to raise a crop of sugarcane. The plans chiefly used for green manuring are Karala (Verbesina sativa) and Tag (Crotolaria juncea.)

SEWAGE MANURING will be referred to under irrigation.

PLOUGHING] Having spread the manure on the dry hard surface the cultivator proceeds to plough it in with the large primitive plough called the Deccanee. *Nanger* is a large edition of the iron pointed stick universally used for ploughing in India. It is drawn by 8 bullocks and costs Rs. 7 which is paid like the greater part of agricultural work chiefly in kind. The part which would represent the body, share and sole of an improved plough is in this implement a nearly equilateral triangle with its base upwards about 9 inches on each side at the thickest part, where it is joined by an iron share projecting 4-6 inches beyond the timber.

Draught is effected by ropes or chains fixed at A.

Depth of working is controlled by moving the long Rear Yoke towards or away from the free end of the beam.

The 'plough' is kept steady by the ploughman holding the handle B.

The Rear Yoke is 3 feet long evidently to keep the feet of the Rear pair of oxen away from the share.

The leading Yokes are 2 feet long.

In this district the timber of the Babul tree (Acacia arabica) only is used for making ploughs and the curves which may be observed in the beam and yokes are intended to accomodate to the character of the timber which is very much crooked but remarkably strong. Some districts where the Babul tree does not prevail have those curved parts straight.

The Deccanee Nanger appears a clumsy, yet it is suited in a remarkable degree to the stiff black soil, it has grown upon, because its long point goes well underneath the hard surface acting where the soil is moist and gradually upheaving the soil instead of cutting it. This point appears not to have been sufficiently attended to by makers of improved ploughs for the Deccan. Improved ploughs are generally furnished with a coulter to cut the sod vertically. Tho soil here never has a sod and the upper four inches are during the ploughing season as hard as a turnpike road. The chief defect of the Deccanee Nanger is, it does not clear out the furrow well, and the bullocks have a very precarious footing which affects real powers of draught greatly.

The effect of the first ploughing is to open V shaped furrows 9 inches wide and 7 inches deep, one furrow touching the other when well done but often with some inches between them. A second ploughing is then given across the first and the clods left to weather or gone over with the Mine,—a log of timber with a longitudinal groove on the lower side. The log is prevented from turning by a beam attached to the yoke of the oxen and the driver stands on the log This is a rough but fairly efficient clod crusher or roller. It is drawn by 4-6 bullocks.

Subsequently a third ploughing going 10 inches deep is given and if this has not been sufficient to bring the soil into a thoroughly friable condition, it is ploughed again. Sometimes the manure is put in previous to the last ploughing. For sugarcane, the cultivators say the ground should be ploughed seven times, this obviously is an equivalent to the English expression 'thoroughly worked.'

When the soil is sufficiently worked, the plough is shortened up so as to take a broad shallow furrow and drawn by one steady pair of oxen; the soil is ridged up in lines running across the slope, the ridges are two feet apart and are crossed at intervals of 10 feet by furrows intended for channels. The furrows are then dressed with the hoe and are ready for the water and planting sets.

The Plough Cattle.

The Deccanee Bullock is a very fair draught animal, highly intelligent when well treated, willing to work and obeying the voice of his driver. The average weight of the oxen is 700 lbs. and the tractive force in the plough is one-seventh of the weight of the oxen, when working with the precarious footing Deccanee clods give.

There is room here for improvement on the lines adopted for steam ploughing. If it is desirable to have the motive power applied from a firm base by means of a wire rope when ploughing by steam, why should it not be the same in ploughing with cattle?

Varieties of Cane Cultivated.

The variety of cane cultivated is called Poonda. It is a pale yellow soft variety averaging 3 lbs in weight for ordinary cane, but specimens 8-10 lbs in weight are common. It differs in no important characters from a much larger cane cultivated in the Concan and brought to the Bombay market for eating purposes which is said to be the Mauritius cane introduced about 50 years ago. Elderly cultivators say the Poonda cane was not known in this district in their youth.

Kalaouse, a dark purple skinned variety of medium size and hardy character, is still widely cultivated in the country but has been driven out of this district by the Poonda variety which is said to yield more.

Kullakee, a variety of small diameter but growing to a great weight, is valued in some districts where wild pigs and jackals abound, because it is so hard that vermins injure it less than other varieties. In a few places near the hills this variety can be grown without irrigation.

A striped yellow and purple cane also valued as a soft juicy cane for the mill is grown locally to a small extent.

Planting the Cane.

The planting season extends from February to April but the Irrigation Department insists on the planting being finished during the first half of that period.

The sets 'bena' are pieces of cane having each three buds and weighing when made of good cane 6½ oz. but procurable in the market at about Rs 2 per 1000.

The entire cane is used to make the sets and it is observed that the top, unripe portion, shoots more quickly than the other parts.

Formerly much ostentation obtained at cane-planting but now the work is gone about as quietly as any other Agricultural operation.

The sets are prepared by laying a cane on the head of stake driven into the ground, the cane is then struck sharply with a sickle and cut into pieces about one span in length.

The sets are carried to the field, laid on the tops of the ridges, then water is turned on and a portion thoroughly watered. The planter then steps into the mud, lays the sets in the bottom of the furrow one span apart and, placing his foot on each in turn, causes it to sink about 3 inches into the mud horizontally if the cane is ripe, but with the top upwards in the case of the unripe top (Wadha.)

Weight, Distance Apart and Number of Sets per Acre.

70 sets weighing 25 lbs. plant 200 square feet, being two six-seventh sqr. feet per set, which gives 15246 sets per acre. Nearly 1 lb per square yard or 1 ton 18 cwt 3 qrs 16 lbs per acre. These figures refer to well developed cane which only should be used for planting. In many instances the cane is smaller and the number of sets greater.

Irrigation.

The watering given to field during planting being applied to a dry open soil, its effect on the surface disappears soon and a second watering must be given within four days after planting.

The subsequent waterings during dry weather will vary from 5 to 10 days apart according to the nature of the soil. Thin light soils will receive water once in ten days with benefit. In this matter much judgment can be applied with benefit. In no case should the soil be allowed to become dry and hard during the growth of the cane and stagnant water must be scrupulously avoided.

The quantity of water required per acre varies from 60 to 100 tons each watering. the latter quantity is nearly 1 inch over the surface of an acre and is a thorough water for a light soil. 60 tons is a sufficient watering for a retentive deep soil.

For some crops that are deep-rooting, it is advisible to water thoroughly at considerable intervals, but sugarcane is not deep-rooting, its roots seldom penetrating more than one foot from the surface and the soil should be kept moist during the whole period of growth.

Canal Irrigation is charged for at the rate of Rs 25 per acre for a 12 months' supply of water sufficient for the crop.

Well Irrigation] Among the cultivators near Poona there is a strong feeling in favour of well irrigation but reliable statements are most difficult to obtain. In instances where a decided superiority is observable, it is easy to ascribe it to other conditions. For instance, land in the immediate neighbourhood of a well is likely to be thoroughly drained, although the soil may be wet, there is little probability of water stagnating and the superior aeration of the soil is sufficient to account for the difference in produce. It would require a most elaborate series

of experiments to settle this question and it is doubtful whether the game is worth the candle, but it must be borne in mind that near Poona there is nothing deleterious in the soil to cause one kind of water to be better than another. In some districts particular wells are unfit for use in irrigation from the quantity of salt the water contains.

[*To be continued.*

SUGARCANE CULTIVATION IN ASSAM.

Varieties] There are various kinds of sugarcane grown in different parts of India. Amongst these *dhali, kajli, kasooi,* and *nata* are chief. In the terai of the Himalaya a variety of thick and plump cane is grown very much like what is called in Assam and Bengal Bombay-cane. The time of planting extends from March to April and that of harvesting from December to March. In places where water is scarce, the cultivators harvest their canes within Decmber-January, for if allowed to stand longer, they run the risk of being dried up. The yield of early harvest is somewhat less than that of the later one when the crop matures better. But the *gur* from early harvest sells much dearer and this somewhat makes up for the loss of early harvesting.

If it be possible to irrigate the crop once by the end of December or beginning of January, the canes do not want any more water till the end of February and by the beginning of March the cultivators begin to cut their canes and press out their juices for *gur-making*. But of course where cane is very largely grown, harvesting continues till late in April or even beginning of May. The yield however of the late harvested canes is always greater.

At every joint or node of the cane, there is an 'eye' or bud and every section of a cane in which there is an eye can be used for planting. Usually the whole cane is seldom cut into bits for planting. The top or immature portion is used for planting while the mature and ripe portion is pressed and juice extracted for *gur* making. The top portion which is used for planting and is called *daga* is usually about a foot long. From one *daga* there arises a cluster consisting of eight to ten pieces of canes. The number of canes which go to form a cluster is sometimes larger. These are joined together by their own leaves and thus support one another.

The dried up leaves of the canes are used for making fire wherewith to boil the juice. It is commonly believed, *gur* prepared by boiling the juice over a fire of cane-leaves turns out to be of superior quality to what is prepared otherwise. Similarly turmeric prepared by boiling over turmeric-leaf-fire, rice prepared over rice-shoe-fire, and milk boiled over cowdung-cakes are supposed to be of superior quality. In some localities, cultivators strip the *dagas* of their leaves and plant them naked on their permanent beds at once. But generally speaking they are first planted in a seed-bed whence they are transferred to their parmanent beds. The preparation of seedlings in the seed-bed is not a very difficult process. It has already been said that each *daga* is about a foot long. Before planting these are stripped of their leaves and put into bundles of 15 each. When the bundles are ready, they are placed in a bed prepared beforehand called *aphore* or *hapore.*

The soil of the bed is turned up with a spade and, mixed with little water, is converted into a sort of puddle. The bundles of cuttings or *dagas* are put in the beds with their tops pointing upwards. This system of raising the young plants in a bed before being planted out into their permanent fields is called "puddled *hopore* system." In this system, the cuttings should not be stripped of their leaves before planting in seed-beds, but left till they become half rotten. The leaves are then stipped off and the "naked" cuttings placed in dry *hapore.* The site best suited for a *hapore* is either by the side of a tank or marsh or under the shade of a tree. At least a fortnight before being planted out in their permanent beds, the seed-cuttings are removed from the puddled seed-bed and placed in the dry hapore, which latter must always be under the shade of a tree. The site of dry hapore should be thoroughly cleaned of grasses and weeds, and close by it there should be dug a pool holding water mixed with cow-dung.

While the cuttings are being removed from the puddled seed-bed and stripped their rotten leaves on the one hand, on the other hand they are bathed in the cowdung-water of the pool mentioned above, placed slightly inclined in the cleaned site and then covered over with a thin layer of very fine sand. On the top of this layer, another series of seed-cuttings are placed and covered over with sand, and so on till all the seed-cuttings are finished. This is what is called the system of placing seed-cuttings in *dry hapore.* Sometimes the cuttings are not removed from puddled seed-beds for two months, but they are never seen to lie more than fifteen days in dry beds. While in these beds both puddled as well as dry, they are slightly watered every day, but if the puddled bed is very near a tank or close to a marsh,

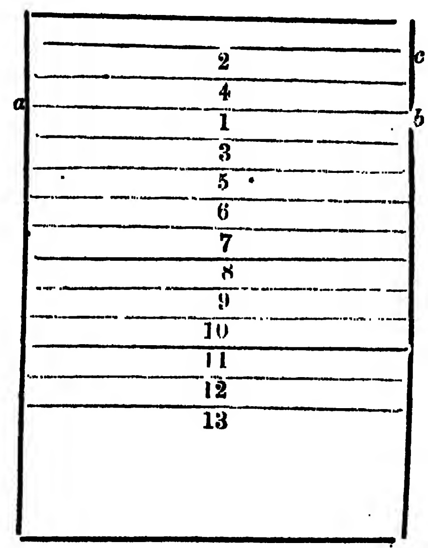
watering may not be necessary. To prevent cattle straying into them, the seed-cuttings are protected by hedges of prickly plants.

When the cuttings lie about ten days in the dry seed-bed, fibrous roots begin to appear from the joints.

If immediately after harvesting, it becomes necessary to plant the same field with sugarcane, the seed-cuttings can not be prepared in the way above described. They are left only for about ten days in the puddled beds and about five days in dry beds. In some places, the practice is to plant out the prepared seed-cuttings entire, in other places each cutting is divided into a number of parts called *goolias*, each goolia consisting of two or three joints only. Whether planted whole or as goolias, there does not seem to be much difference in the result. Whatever be the number of joints in a cutting, it gives rise to one plant only, which latter tillers and produces in time a bunch of canes. The side-canes which spring up till the beginning of August give rise to good crop but those that are produced later on seldom do well and prevent the proper growth of those that are produced early in the season. Hence it is that the side-canes which spring up late in the season are removed. The seed-cuttings are planted at equal intervals. About 6,400 cuttings are required to plant one bigha (⅓ acre).

Thorough tillage and heavy manuring are essentially necessary for successful cane-growing. The land must be ploughed seven or eight times and manured early in February with farmyard-manure and broken down old mud walls or earth obtained during re-excavating old tanks, the former at the rate of 40 maunds and the latter 20 maunds per bigha. By the end of March preparation of land for the permanent reception of sugarcane cuttings must be over. By the beginning of April, the cuttings ought to be planted. But the planting goes on sometimes till May, in which case the canes become stunted in growth and do not tiller well. Fallow lands ploughed up during previous rains and lands recently brought under plough, are suited for the growth of sugarcane. Fallow lands immediately brought under plough, say during February and March, do not grow canes at all. Lands that are not well drained are not fit for their growth. When the plants have grown sufficiently tall, they do not suffer much from flood water, provided the canes are not totally submerged; in the latter case, they are entirely lost. Sugarcane lands must be thoroughly level, otherwise irrigation becomes impossible. Loamy, alluvial and even clay soils grow sugarcane, but the first two classes of soils are most suited for the crop. The juice of the canes grown in the latter class of soils is more watery, the proportion of *gur* to water being one to five or six, and the crystals smaller. Canes grown in clay soils are not so heavy but the juice is less watery, the proportion of *gur* to water being one to four and the crystals larger. So in fact, level lands with clay-soil are best all round for the growth of sugarcane.

The cultivators in this part of the country plough the land in a peculiar way before planting. This is called by them *khara* or opening furrows. The way in which furrows are opened is shown in the diagram.



The lines in the diagram are the *khras* or furrows which are a foot and half apart. The plough goes through the same furrow twice, in order to render it deep and wide enough for the reception of the seed-cuttings. In ordinary ploughing, the ploughs while turning near the hedge of the field at the end of every furrow, are not taken out of the soil; but in opening furrows for sugarcane planting, they are taken out of the soil altogether at the end of every furrow while turning. The plough begins to open the furrow at *a* and goes up to *b*; from *b* the plough is taken out of the soil to the point *c* and the furrow opened from *c* towards the point opposite to it. Then the furrows marked 2, 3, 4 and 5 are opened one after the other. From the furrow marked 5, the plough returns to the furrow marked 2 and deepens the latter; and so on from 2 to 6, 6 to 4, 4 to 7, 7 to 1, 1 to 8, 8 to 3, 3 to 9, 9 to 5, 5 to 10, 10 to 6, etc. Thus at every turning of the plough one new furrow is opened and one old one deepened. One plough can open and deepen the furrow of one bigha (⅓ acre) of land in a day. The *goolias* or *dagas* (cuttings) are planted in these furrows.

One man places the cuttings in the furrows, one man waters them with a pale of water,and a third man covers them up. The last man presses down the cuttings a little bit in the moist soil, then covers them up with soil lossened from the ridges, and finishes the operation by giving a final pressure over the top soil. He is more careful in cases of transplanting than when planting cuttings which had not previously taken roots in the seed-bed.

When furrows are opened, the land is necessarily thrown up into ridges and furrows; but after planting is over, the land becomes level again. 12 men are ordinarily required to plant one bigha. Sugarcane fields ought to be enclosed by hedges, to prevent ravages from cattle etc. This also requires about 12 men.

When the planting is over, with the first shower of rain ..the cane field is dug up once with the spade. The welfare of sugarcane depends great deal upon the care which is bestowed in digging up the land the first time after planting. After every shower, when the land gets a little dry, the land is dug up with the spade. From May to August, the land according to the nature of the year, is dug up from six to ten times. With every digging the land is thrown into ridges and furrows, the canes lying in the furrows and the ridges coming in between them. By the end of August or beginning of September, the ridges are broken up and the canes earthed up. No more digging is necessary after this.

While digging goes on on one hand, canes are joined together on the other hand by means of their own leaves. The leaves are not entirely separated from the plants, but they are bent downwards by means of a slight pressure at their junction with the cane-sticks. All the leaves are thus used, excepting a few leaves, say 5 or 6, at the top. Care must however be taken that the canes are not overburdened with too many leaves, as it prevents the growth of the plants. Hence it is that it becomes sometimes necessary to separate the lower leaves, as otherwise the leaves grow at the expense of the stem.

With a heavy crop twice, and with a light one once a month, the cultivators bind the canes with leaves. When the canes grow more than 4 cubits high, the tops of 4 adjacent bundles are joined together, as otherwise they are apt to lodge with the wind. A good crop of cane always requires this last process of joining the heads of 4 bundles.

If ordinary hand-presses are used for pressing the canes are cut into lengths of about 2½ to 3 ft. each. If after topping them for seed-cuttings, the canes yield only one length, they do not yield more than six maunds of *gur* per bigha; if two lengths, the yield of *gur* amounts to from 24 to 30 maunds, if three lengths, the yield of *gur* runs up to as high a figure as 60 maunds per bigha.

Cost of growing one bigha of sugarcane.

	Rs.	As.	P.
10 cart-loads of dung and 5 ,, ,, earth at the rate of 2 annas for carting each time	1	14	0
Price of dung etc,	1	0	0
5 labourers for digging with spade	0	12	6
3 labourers with the cart ...	0	7	6
6 ploughs ...	1	8	0
Seed-cuttings 6400 .	5	0	0
Planting, 12 labourers ..	1	14	0
Hedging, 12 labourers .	1	14	0
Digging 6 times, 6 labourers at a time or 48 in all ..	7	8	0
Binding, 12 labourers .	1	14	0
Irrigation in December .	2	0	0
Cane pressing for ordinary lands	17	8	0
Rent, say	2	0	0
	45	4	0

Profit per Bigha.

21 maunds of gur @ Rs 2-8-0 per maund . ... Rs 52-8-0
Net Profit ... ... Rs 7-4-0

The net profit is not generally so low as shown here. Usually the net profit amounts to the sum equal to the cost of growing. Owing to seasons being irregular and various other difficulties, now a days the profit has fallen so low as shown above.

NEWS.

The Indian Wheat Crop of the Season 1885-86.

The harvest being now completed, the following estimate has been made of the area under wheat, and the outturn during the year 1885-86, in the Provinces of the Punjab, the North-Western Povinces and Oudh, the Central Provinces, Bombay, and Berar, which taken together, comprise in ordinary years nearly three-quarters of the total area of wheat cultivation in India. For the remaining one-fourth which is contained in Bengal and in the Native States of the Rajputana and Central India Agencies, Mysore, and Kashmir, the figures are less trustworthy, owing to the absence of any organised agency for testing area or outturn. The normal area under wheat in India is believed to be

about 26,000,000 acres, of which the average outturn is estimated roughly at 7,135,000 tons. The whole area cultivated in the year 1885-86 is estimated to have been approximately 27,392,742, acres with a yield of about 7,739,424 tons. The following table compares the actual area and outturn of the Provinces enumerated with the area and outturn of average years :—

Province.	Supposed normal area under wheat.	Area ascertained by inspection up to April 1886	Estimated outturn of area in column 3.
	Acres.	Acres.	Tons
Punjab ...	7,000,000	6,957,600	2,695,000
North-Western Provinces and Oudh	5,037,000	5,240,381	1,847,400
Central Provinces	4,000,000	3,902,707	859,753
Bombay (including Baroda) ...	1,883,000	2,969,539	801,4[illegible]
Berar	803,000	808,515	115,[illegible]2
Total ...	18,723,000	[illegible],878,742	6,31[illegible],[illegible]15

The latest reports give the following accounts of the crop. In the Punjab, notwithstanding some want of moisture at sowing time, the yield promised well in most districts, the rainfall having on the whole been very favourable. Easterly winds have caused injury in some parts, but the crop is quite up to the average. In the Central Provinces want of moisture at first, and subsequently excessive rain affected the sowings. The weather later was favourable, but blight appeared in January and February and the crop over a considerable area of the Provinces has been very far from good. In Bombay the season has been on the whole favourable and the crop promised well. In Berar the crop gave early promise of a bumper outturn, but the untimely and heavy rainfall in December and the cloudy weather in January caused rust and blight, and much damaged what seemed likely to be a splendid crop, particularly in the Wun and Bassim districts. In the North-Western Provinces and Oudh the month of April characterized by dry high winds which shrivelled the ungathered crop of the irrigated tracts. The following table compiled from the annual trade reports shows the exports of wheat from India for the past six years :—

	Tons.
1880-81	372,218
1881-82	993,176
1882-83	707,220
1883-84	1,047,824
1884-85	792,714
1885-86	1,053,025

The following table shows the share of each Port in the total quantity of wheat exported during the last four years:—

Ports	1882-83	1883-84	1884-85	1885-86
	Tons.	Tons.	Tons.	Tons.
Calcutta ...	221,970	380,576	128,160	205,483
Bombay ...	347,887	448,530	449,655	530,434
Karachi ...	136,616	218,642	214,719	312,051
Madras ...	329	76	65	93
Rangoon ...	418	...	115	96[illegible]
Total	707,220	1,047,824	792,714	1,053,025

The following table shows the countries to which the wheat was exported :—

Countries.	1882-83.	1883-84.	1884-85.	1885-86.
	Tons .	Tons.	Tons.	Tons.
United Kingdom	328,758	525 413	372,249	603,561
Belgium ...	72,944	129,678	86,934	183,079
France ...	178,385	169,895	165,748	107,262
Holland ...	28,912	9,637	4,627	4,296
Italy ...	8,806	22,276	35,045	60,913
Egypt ...	39,977	165,299	110,575	114,807
Other countries	49,438	25,626	17,536	29,107
Total	707,220	1,047,824	792,714	1,053 025

After the issue of the final Memorandum on the outturn of the Wheat Crop of the Season 1884, a Circular was issued to the Governments of the chief wheat-producing provinces, asking for such additional information as could be given in regard to the character of the export of the season, changes in the route taken by exported wheat, the effect on the Indian price of wheat of the price in foreign markets and of fluctuation in the prices of other food-grains and the cost of export from the place of production. From the replies received to these enquiries and from such information as has since been received the following note has been compiled. The information procurable is of a fragmentary character, and the figures given, though the best at present available, are generally only approximate. The division now usually adopted of the varieties of Indian wheat is into red and white, each of these being further separated into hard and soft. In the *North-Western Provinces and Oudh* the varieties grown are—

On about 2 millions of acres, red.
" " 2 " " red and white, mixed.
" " $1\frac{1}{4}$ " " white.

Over a third of the white wheat is grown in the Meerut Division

In the *Berar*, though a certain amount of hard white wheat is grown, hard red wheat is the most common variety. In the *Bombay Presidency* the most characteristic varieties are hard white wheat in the Deccan, soft red wheat in the neighbourhood of Ahmadabad, and soft wheats, both red and white, in Sind. In the *Central Provinces* the classes of wheat in principal demand are the soft white variety known as *pissi* and the hard red. Soft and hard wheats are grown in nearly equal proportions. The great extension of the area under the soft varieties since the export of wheat to Europe began, is one of the most notable facts in the agricultural history of the Provinces, and furnishes powerful evidence of the readiness of the Indian cultivator to adapt himself to a change of circumstances. In the Hoshungabad Settlement Report, written 20 years ago, the *pissi* wheat mentioned above is described as a "very inferior wheat" grown on a very limited area. The demand for soft wheat for export to Europe has brought *pissi* to the front rank, till it now engrosses two-thirds of the total area under wheat in that district. The wheat most commonly grown in the *Punjab* is the soft red, which requires less irrigation and less manure than the more valuable soft white wheat. In a Resolution recorded by the Government of the Punjab on the 19th March last, it was estimated that soft red wheat was grown on 5 millions of acres out of a total of 7 millions of acres under cultivation in the Province.

The area under wheat in the Bombay Presidency is believed to have more than doubled during the last twelve years. A further increase is anticipated on the completion of the Southern Marhatta Railway, which will bring the wheat of the Kanarese Districts to Bombay for shipment. This wheat, though of good quality and grown extensively, is not exported at present. The opinion of the Director of the Bombay Agricultural Department, it may be added, confirms the view expressed by the Government of India in the Memorandum issued in June 1885, that the export of wheat, going on, as it does, side by side with an increase in the production of other food-crops, is of substantial benefit to the exporting population. According to the figures given, the outturn per acre for each of the Provinces is as follows:—

	1884-85. Cwts.	1885-86. Cwts.
North-Western Provinces and Oudh ...	8· ...	7·0
Central Provinces ...	5·1 ...	4·4
Berar ...	2·5 ...	2·8
Punjab ...	7·7 ...	7·7
Bombay (including Baroda and Native States under the political control of the Bombay Government.) ...	5·6 ...	5·4

The average outturn in Berar would appear from a report received by the Government of India in 1882 to be about 3·5 cwts. In 1884-85 the outturn was estimated at 2·5 cwts only, the heavy rain of the year having caused blight. In 1885-86, the yield rose to 2·8 cwts., though the season seems to have been little better than its predecessor.

The exports by land during the last three years are given below:—

	1882-83. Tons.	1883-84. Tons.	1884-85 Tons.
North-Western Porvinces and Oudh	164,255	303,497	135,688
Central Provinces	204,039	275,295	349,683
Berar ...	43,830	23,211	19,709
Punjab	174,652	243,516	387,307

The figures for Bombay are not given, as the imports of that Presidency by land are greater than the exports by land. The exports of wheat from the North-Western Provinces and Oudh in 1883-84 were exceptionally large, notwithstanding the low prices ruling in the market. Trade was then very dull till nearly the end of the following year, when it began to recover. Most of the wheat from these Provinces is consigned to Calcutta, the rates of freight to which port are lower than those on consignments to Bombay.

The trade of 1884-85 in the Central Provinces does not appear to have suffered from the depressed state of the English market. Most of the wheat is exported from the Nerbudda Division, but a large portion of the apparent exports from the Provinces are really exports from the Bhopal State. The exports from these Provinces go almost entirely to Bombay. Much of the possible wheat-producing area of the Provinces lies at present beyond the reach of railways, and a large development of the wheat trade may be expected to follow the extension of the railway system.

The export trade of Berar has fallen off during the last two years and oilseeds have to some extent taken the place of wheat. The bulk of the exports goes to Bombay. The wheat trade of the Punjab has increased rapidly during the last two years, the quantity (387,307 tons) exported in 1884-85 being more than double that (174,652 tons) exported in the year 1882-83. The circumstances of the Punjab and Central Provinces, as wheat-producing tracts, differ considerably. In the former Province wheat is chiefly grown for home consumption, the surplus only, about one-eighth of the total outturn, being exported; whereas in the Central Provinces the export trade gives the chief impetus to wheat cultivation, and not more than half of the crop raised is consumed locally. In the great portion of the Punjab the rains are precarious, and the wheat crop, where not protected by artificial irrigation, is liable to failure from drought. In the Contra Provinces the rains rarely fail; a large quantity of fertile soil requiring little labour is available, and the only check to production is the existing difficulty of carriage.

The following table compiled from the Internal Trade Reports, illustrates the wheat exports from each province to Bombay, Karachi, and Calcutta, during 1883 84 and 1884-85. Statistics for the year 1885-86 are not yet available :—

From.	Bombay.		Karachi.		Calcutta.	
	1883-84. Tons.	1884-85. Tons.	1883-84. Tons.	1884-85. Tons.	1883 84. Tons.	1884-85. Tons.
Central Provinces ...	266,570	347,177	...	...	794	1,114
Punjab	49,991	21,170	177,235	270,141	7,549	4,203
North Western Provinces & Oudh	20,421	9,196	...	...	251,709	110,037
Rajputana and Central India	10,571	19,504	...	...	...	...
Berar	21,016	18,451	...	...	...	...
Bombay Presidency ...	63,784	62,571	...	...	...	...
Lower Provinces of Bengal (Behar)	...	...	...	...	140,083	15,847
Other places	835	16	...	...	297	626
Total ...	493,188	478,085	177,235	270,141	400,432	167,827

Most of the wheat consigned to Bombay shipment comes from the Central Provinces, which, as already noticed, export chiefly the white varieties. The soft white variety is, with exception of Sind, not grown in the Bombay Presidency, where the soil and climate are unsuited to it. The hard white wheat of this Presidency fetches a high price in Italy, where it is converted into macaroni. It is preferred also for consumption by the people of Bombay to any other kind, and is, therefore, only exported when supplies are large.

In 1883-84 the harvest were abundant in the United States and in Europe, and the stocks in hand were large. The exports from India in 1884-85

by sea amounted to only 792,714 tons against 1,047,824 tons in 1883-84, though they exceeded the exports of 1882-83 by 85,494 tons. The crops of 1884-85 in the United States and in Russia were much below the average, while those in India yielded a very fair average outturn. These facts, coupled with low prices, abundance of other food-grains, cheaper carriage, low sea freights and perhaps low rates of exchange, were all favourable to the expansion of the wheat trade of India with England. In 1885-86 this country exported by sea 1,053,025 tons,—the highest figure on record. In the subjoined table India is compared with Russia and the United States, as an exporter of wheat to the United Kingdom:—

Period.	Imports into the United Kingdom from — Russia.	United States.	British India.
	Tons.	Tons.	Tons.
Year ended on the 31st December—			
1883 ...	664 667	1,303,291	562,174
1884 ...	270,098	1,130,306	400 495
1885 ...	599,317	1,213,935	605,098
Three months ended on the 31st March—			
1884 ...	44,019	302,856	94,734
1885 ...	64,649	352,332	86,596
1886 ...	60,005	176,461	162,110

The figures given below show that, while Bombay is the main outlet for Indian wheat, a rapidly increasing share of the export trade takes place by way of Karachi. The wheat exports by sea, from the latter port have risen from 8,473 tons in 1880-81 to 312,061 tons in 1885-86.

Proportion of the share of each Maritime Province in the total quantity of wheat exported by sea.

	1882-83.	1883-84.	1884-85.	1885 86.
	per cent.	per cent.	per cent.	percent.
Calcutta ...	31·38	36·32	16·16	19·89
Bombay ...	49·19	42·80	56·72	50·37
Karachi ...	19·31	20·86	27·08	29·63
Madras ..	·04	·007	·008	·009
Rangoon ...	·06	...	·01	·09

In 1884-85 the exports of wheat from Karachi (214,719 tons) for the first time exceeded those (128,160 tons) from Calcutta. As regards the flow of trade from the Punjab the exports to Karachi are increasing, while those to Bombay are falling off. The condition of the wheat crops of 1885-86 in the United States and the Continent of Europe is reported to be, in the main, favourable, so that, so far as can at present be foreseen, no exceptional demand for Indian wheat during the current year is probable. In the opinion of the Director of the Local Department of Agriculture the fall of prices in England in 1885 affected the Bombay market, but did not have its full effect owing to a simultaneous fall of freights. In the Bombay Presidency, especially in the chief wheat-growing districts of Ahmadabad, Nasik, Khandesh, and Ahmadnagar, the first five months of 1885 were a period of low price, compared with the corresponding period in the preceding year. In one district, Dharwar, owing to deficient rainfall, this state of things was reversed, the period of low prices in 1884 being followed by one of high prices in 1885. Wheat shared in these rises and falls with other food-grains, *jowari* and *bajri*, but its fluctuations were not abnormally high or low. Information is not available from other provinces.

The quantity of wheat available for export in the North-Western Provinces and Oudh during the current year is put down at 166,406 tons. As regards the prospects of the trade of the current year, the Director of the Agricultural Department has written:—

"The prices of wheat at every station of the Provinces for the 10th April 1886 when the market opened ranged from 5 per cent. higher than prices for the corresponding period of last year. The prices at the ports are also higher but not to the same extent, and do not appear to be paying at present for exporters from any part of the Provinces except portions of Rohilkhand, Oudh and Benares Divisions; the local prices plus freight from other stations exceeding the port prices.

During April 1886 the total exports to Calcutta (which takes nearly 80 per cent. of the entire quantity sent out of the Provinces) amounted to 13,984 tons only against 26,692 tons sent last year. Much of this was, however, sent at a loss, and was despatched simply to fulfil time bargains contracted in February last when very high hopes of the present crop were entertained. The London quotations are 32*s.* 6*d.* per quarter against 33*s* to 34*s.* 6*d.* per quarter last year, sea freights and the rate of exchange, however, compare favourably for exporters with those of the past year :—

	1885. £.	s.	d.	1886. £.	s.	d.
Sea freight to London (per ton) from Calcutta	1	15	0	1	11	6
Exchange per rupee at Calcutta	0	1	7½	0	1	$5\frac{27}{32}$

These facts may operate to raise the prices at the port as the port prices plus sea freight and incidental charges still leave a good margin of 1*s.* 9·5*d.* per quarter.

		s.	d.	
Present price in Calcutta at Rs. 2-8-6 per maund	=	22	5·8	per quarter.
Sea freight at £ 1-11-6 per ton	=	6	10·0	"
Incidental charges at Rs. 0-2-6 per maund	=	1	4·7	"
Total ..		30	8·5	"
London price		32	6·0	"
Margin per quarter		1	9·5	"

Taking, however, everything into account, the prospects of the present crop do not appear so hopeful, from a trader's point of view, as those of last year.

PASTEUR AND HIS WORK, FROM AN AGRICULTURAL AND VETERINARY POINT OF VIEW.

By George Fleming, LL.D., F.R.C.V.S.,

Principal Veterinary Surgeon of the Army.

Agriculture, in the widest and most comprehensive sense of the term, depends upon so many collateral sciences, as well as arts, for its continuous prosperity and progressive development, that any marked advancement or important discovery in these must react more or less beneficially upon it, and promote, to a commensurate extent, its welfare. Among the sciences which, for many years, have aided in this direction, perhaps it is not too much to claim for Chemistry a very forward, if not the foremost, place: and among the greatest chemists are those who have devoted at least a portion of their skill and time to the study of what has been termed "Agricultural Chemistry." The chemical composition of soils in relation to the food, growth, and health of plants; the food, feeding, and products of certain animals, as well as the preparation and preservation of many of those products for the use of man; the action of the atmosphere, heat, light, and moisture upon plants and animals; the artificial agents which may be made to second the efforts or supplement the exhausted powers of nature, whether in regard to the soil, the plant, or the animal body—in all these, and in other ways chemistry has lent its powerful assistance to agricultural requirements, and it may truly be said that, without it, Agriculture would lose one of its best benefactors and most worthy helpmates.

In recent years, the science of Biology has also been bestowing more and more of its favours on Agriculture, and is now pushing Chemistry very hard for the first place in respect to the services it can render the oldest of all the arts, and more especially with regard to the elucidation of the problems which surround plant and animal life, be that life in a normal or abnormal condition. And here, in mentioning biology, it is impossible to refrain from alluding to the vastly important and wonderful discoveries which have, within half a century, been made through the intelligent employment of, first, the simple, then of the compound mycroscope. So recently is the date of its most startling revelations, that I myself can remember a rathar distinguished Professor of Medicine, not a quarter of a century ago, designating it a scientific toy, and deriding those who, as he expressed it, wasted their time and their eyes in foolishness. This optical instrument is now far more essential to the man of science, and to mankind in general, than the telescope; inasmuch as it reveals to us the presence of the infinitely little—myriads of minute plants and animals, strange organisms and delicate structures—which, until it was employed, were beyond the visin and the knowled ge of man, all of which take a part in Nature's work, and many of which have a markedly benignant or malignant *role* in the vital operations of the higher plants and animals, they being active agents in the metamorphoses of matter—be it living or dead.

With the introduction of the microscope into biological investigation, a new world in which to make grand conquests has been given to the philosopher and the searcher into life's mysteries, the mysterious phenomena of life and death, growth and decay, building up and breaking down, and even the result of what were supposed to be purely chemical processes, are now within the range of man's scrutiny, and can be ascribed more or less to the operation of the impalpable, and hitherto invisible organisms, the existence of which this optical "toy" has now made us cognisant of. Even "the pestilence which walketh in darkness," destroying man and beast, has been robbed of its mystery by the penetrating light which this ingenious combination of lenses and optical accessories has shed upon it; and man may, by its aid, in time protect himself, and the animals and plants he rears, from disease and destruction, by the knowledge he has thus acquired. Indeed, to some extent this most desirable end has been already achieved; for some diseases, the nature of which was unknown, and in the prevention or cure of which we were simply groping in the dark, are now perfectly understood, and their prevention is based on this understanding; while we are able to make their active cause serve as a protective influence—make, in fact, the bane act as its own antidote—and thus obviate the necessity for resorting to uncertain, oftentimes dangerous, and generally onerous attempts at curing. No greater advance has perhaps ever been made in the medicine of man and animals, than that which has taken place during this half of the nineteenth century; and to none among those who have contributed to this result is more credit due than to Louis Pasteur, by whom the greatest discoveries in the world of microscopic organisms have been made, the solution of intensely intricate and important problems effected, and the varieties of nature—in her darkest and most baffling recesses—demonstrated in a manner which only genius of the highest order could suggest and execute.

It is only too often felt by those who strive to win Nature's secrets, that all the great problems in natural science—such as the nature of heat, of

light, of electricity, of gravity—and still more, all questions connected with life, bring us in the end, and frequently after but a few steps, face to face with infinity and mystery. It has been Pasteur's happy lot to select, or rather to be compelled by destiny to follow, a course which has led to such grand achievements, and at every stage of which he has left his indelible and character-mark. His progress has been along the path which has been already trodden by men of great genius, and pursued unfalteringly through weary days and nights, but along which the love of truth burns as a pure and a guiding light—that *lumen siccum* which Bacon insisted should be found in all philosophers, and which, it would seem, neither failure nor disappointment can quench or dim. As a representative of modern science, Pasteur occupies an advanced position. Cicero has somewhere said, "Opinionem commenta delet dies, naturæ judicia confirmat;" and Pasteur, in this work appears ever to have borne in mind that speculative opinions have but an ephemeral duration, whilst inferences drawn from nature and truth remain permanently on record.

Originally a chemist, by the force of circumstances and a most fortunate concurrence of events, this most distinguished man became a biologist, and finally a pathologist—startling chemists, physicists, crystallographers, and physicians, no less than agriculturists, with his discoveries, and conferring upon civilisation immediate and inestimable benefits in many directions, while opening up a wide region for the fruitful cultivation of other investigators.

However far-extending and diverse the effects of these discoveries may be, and are, the object of this paper is limited chiefly to a survey of their relations to and influence upon Agriculture, and to notice of the circumstances and conditions under which they were made, and the benefits likely to accrue for them.

I have stated that Pasteur was originally a chemist; but it may be mentioned that his training in this science was conducted by Dumas at the Sorbonne, and by Balard at the Ecole Normale, Paris, under whom he became a very competent experimentalist. During his studies in chemistry molecular physics appear to have proved very attractive to him, and at last to have deeply engaged his attention, the molecular condition of crystals forming the chief object of his investigations. The results arrived at in his inquiry, when only twenty-five years of age, into the symmetrical and unsymmetrical (or dissymmetrical) forms of salts apparently identical in chemical composition, were remarkable, and elicited the admiration of the chief authorities on this subject, and especially of the German chemist, Mitscherlich, who had failed to discover what Pasteur had succeeded in demonstrating, though he had devoted many years to it. The conclusion Pasteur came to was, that the unsymmetrical molecules of matter are produced by, or built up under, the influence of vital agencies, the symmetrical being characteristic of inorganic bodies, the two conditions being typical of the physical barrier that exists between organic and inorganic nature. This conclusion has, however, since been questioned, and Tyndall, twenty years ago, in his Fragments of Science, was inclined to maintain that "it is the compounding, in the organic world, of forces belonging equally to the inorganic, that constitutes the mystery and the miracle of vitality."

It is very probable that had Pasteur continued to pursue his researches in chemistry and molecular physics, he would have attained special eminence and these sciences would have greatly benefited. At the early age of thirty-two he was appointed Professor of Chemistry at Strasburg, and soon after (in 1854) was transferred to Lille, as Dean of the Faculty of Sciences in that town, where, for a time, he continued to labour, to verify, and to make deductions from theoretic views, until step by step he had discovered the startling connection that existed between his previous researches in chemistry and crystallographic physics, and the new and entirely unexpected results obtained in physiological chemistry—which connection finally led him, as if it were the thread of Ariadne, to his magnificent discoveries in pathology.

This series of success was referred to by the celebrated Chevreul at the Accademy of Sceinces some time ago, when he said: "It is by first examining in their chronological origin the investigations of M. Pasteur, and then considering them as a whole, that we are enabled to appreciate the rigour of judgement of that learned man in forming his conclusions, and the perspicacity of a mind which, strong in the truths which it has already discovered, is carried forward to the establishment of new ones."

What might have been considered an accident, led Pasteur to abandon his hitherto congenial and highly successful line of research in the domain of chemistry and molecular physics, and enter upon a new but not very dissimilar course, in which his great natural gifts and previous training were to confer such advantages. This was the very important study of fermentation, to which his mind was attracted by an almost casual incident while he was at Strasburg.

The observations of a manufacturer of chemicals in Germany had long made it known that the impure tartrate of lime of commerce, if contaminated with organic matters, and allowed to remain dessolved

in water during warm weather, fermented, and yeilded various products. This excited Pasteur's curiosity, and he prepared some pure right-handed tartrate of ammonia, to which he added some albuminous matter, and placed the liquid in a warm chamber, where it fermented. During the process of fermentation, the previously limpid mixture gradually became turbid, and the turbidity was found to be due to the presence and multiplication of a microscopic fungus, which obtaining its sustenance in the liquid, acted as a living ferment.—*The Journal of the Royal Agricultural Society of England, Vol. XXII.*

CROP AND WEATHER REPORT.

For the Week Ending 2nd June, 1886.

General Remarks.—Rain is reported generally from nearly all parts of India, except Sind and portions of the North-Western Provinces and Oudh, Punjab, Rajputana, and Central India. The falls have been heaviest in the south of the Madras and Bombay Presidency, in Northern Bengal, Assam and British Burma.

In Madras, Mysore, and Coorg the crops are generally in good condition and prospects continue favourable. In Bombay and Berar preparations for the kharif continu In Hyderabad the hot weather crops are still being reap Agricultural prospects are generally good in Central India, but in Rajputana the water-supply is failing.

In the North-Western Provinces and Oudh and the Central Provinces kharif preparations continue and prospects are good. The rabi harvest is still in progress in the Punjab.

In Bengal cultivation is forward, and agricultural prospects are generally very favourable. Prospects continue good in Assam.

The public health is on the whole satisfactory.

Prices are fluctuating in the Punjab and are rising in parts of Rajputana. Elsewhere they are generally steady.

For the Week Ending 9th June, 1886.

General Remarks.—Rain is reported generally from all parts of India, except Sind, the North-Western Provinces, and the Punjab. In the south of the peninsula, in Assam, and in the tracts east of the Bay of Bengal, especially at Chittagong, the falls have been heavy.

In most parts of Madras and in Mysore and Coorg prospects continue good.

Preparations for the kharif are in progress in Bombay, Berar, and the Central Provinces, and have commenced in the North-Western Provinces and Oudh and in the Mooltan and Shahpur districts of the Punjab. The rabi in the Punjab is not yet completely gathered.

Agricultural prospects have improved in Rajputana, the water-supply in most States having been replenished by the recent rain.

Cultivation is going on well in Bengal, and the crops in the ground are thriving. The state and prospects of the crops in Assam continue satisfactory.

The public health is fair in Madras, Bombay, and the Central Provinces, and generally good elsewhere.

Prices, except in the Punjab, where they are fluctuating, are generally steady.

For the Week Ending 16th June, 1886.

General Remarks.—Rain has been general in the Madras Presidency, in the Southern portion of the Bombay Presidency, in Berar and Hyderabad, in Southern and Eastern Bengal, and in Assam. In Coorg the fall has been heavy. Slight rain has fallen in parts of the Central Provinces, the North-Western Provinces, Rajputana, and Central India.

In Madras the standing crops are generally in good condition and prospects are fair. Prospects are good in Mysore and Coorg.

Kharif preparations are in progress in Bombay, the Central Provinces, Berar and Hyderabad, and have commenced in the North-Western Provinces and Oudh and in Rajputana. In the Punjab the rabi harvest has been nearly finished.

Cultivation is progressing in Bengal and prospects are favourable, but more rain is wanted in many places for sowings. Prospects are generally good in Assam, but more rain is wanted in Cachar and Dibrugarh.

No report has been received from British Burma for the week under notic

The public health continues fair.

Prices are steady, except in some districts of the Punjab and the Bangalore district of Mysore.

For the Week Eending 23rd June, 1886.

General Remarks.—Rain is reported generally from all parts of India, except Sind, the western districts of the Punjab, and some places in Rajputana. The falls have been heaviest on the Bombay coast, at the head of the Bay of Bengal, and in the North-Western Provinces and Oudh.

In Madras, Mysore, and Coorg the standing crops are in good condition, and prospects are on the whole favourable.

Ploughing and sowing for the kharif crops are in general progress in Bombay, Berar, the North-Western Provinces and Oudh, and the Central Provinces, and have commenced in the Punjab and Rajputana.

In Bengal sowings of aus rice and jute have been generally completed. Ploughing is in progress in Assam, and agricultural prospects are generally good.

The public health is generally good in all Provinces.

Prices are fluctuating in the Delhi district, and rising in the Shahpur district of the Punjab, and have slightly fallen in Bangalore. Elsewhere they remain generally stationary.

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THEORY AND PRACTICE OF AGRICULTURE.—This was the subject of a lecture delivered by Mr A. C. Sen, in a public meeting held on the 17th instant for the purpose in Serampore. Mr Ritchie, the Magistrate of the district, presided. Our readers are perhaps aware that Mr Sen went to England to study agriculture and passed out of the Royal Agricultural College at Cirencester in 1885 most successfully. Since his return he has been appointed to the statutory civil service and is now serving the Bengal Agricultural Department in the capacity of an Assistant to the Director of Agriculture in the Burdwan Division. The lecturer began by saying that there are two sources from which plants are supplied with food, namely. atmosphere and soil. The supply of atmospheric food is unlimited and beyond the range of human manipulation; but the elements of plant food removed from the soil should be restored, if the fertility of the soil is to be maintained. This restoration to the soil of plant food removed by plants, is the keystone of all agricultural improvements, and is entirely within the range of human manipulation. Most of the elements thus removed are present in the soil in great abundance and their exhaustion is practically out of the question. The elements of plant-food which are essential and which soils are deficient in, are potash, phosphoric acid, lime and nitrogen, and a restoration of these is necessary to maintain the fertility of the soil. Referring to the practice of agriculture, the lecturer said that in Bengal the cultivators in order to restore fertility to their soils can use manures of which the following are easily available, namely, cowdung, pond-mud, oil-cakes, bones, and saltpetre. As regards cowdung he said that its quality depends good deal on the mode of feeding and the mode of conserving the dung. A cow fed on rich food as oilcake, grains, etc., will yield a richer dung than one fed merely with straw and green grass. Similarly exposure to rain and heat robs it of its valuable materials. Pond-mud, he said, should be thoroughly dried and aerated before being incorporated with soils, as not unfrequently it contains poisonous matters which are rendered innocuous by aeration. He next referred to the high manurial value of saltpetre which however he said should be used with caution. The ability with which the lecturer handled the subject showed him a thorough master of it and it is a great pity that the services of men like Mr Sen are not utilized by Government in a more useful sphere of action.

* * *

TEXTILE FIBRES AND SILKS OF INDIA IN ENGLAND.—The first of the conferences in connection with the Indian and Colonial Exhibition which are now being held in London, was devoted to the fibres suitable for textile purposes. About 50 different fibres were placed upon the table before about a dozen interested merchants and manufacturers, who carefully went over these and expressed themselves pleased with the attention showed to them by Mr. Buck and his technical assistant Dr. G. Watt. A suggestion was formulated by the gentlemen present which Mr. Buck thought the Government of India would be glad to take into consideration. It was found that a vast

number of fibres which had never before been shown in London were now on view, but that, although many seemed interesting and promised to find a distinct market, it was impossible for merchants to form any opinion until the fibres had in the first instance been examined by a chemist; there were so many points which it was necessary to ascertain and which the chemist alone could do. Mr. Cross, a professional chemist present, offered to undertake the scientific examination of all the fibres, and Mr. Joynsen made a liberal offer to contribute towards the expense of this very necessary first step. Mr. Buck stated that the Government of India would gladly afford every assistance to Mr. Cross, and would be pleased to publish the report. At the second meeting to examine silk samples and silk substitutes, about the same number of gentlemen were present, and Mr. Wardle, the well known silk dyer of Leeds, in a very instructive manner drew attention to the leading forms of Indian silks and conducted them to the bazar, where an Italian woman, a professional reeler, was seen at work on the Bengal mulberry insect, and the Indian boys reeling tusser silk. After the inspection of the silks, the gentlemen present went to the Economic Court to examine silk substitutes, and expressed a strong opinion in favour of one or two, more particularly the jute-like fibres from *sida rhombifolia*. This was pronounced superior to most fibres exhibited for this purpose. The fibre is as fine as silk, is about the same weight and is of a bright silvery lustre, and can be produced as cheap as jute, while it is much more durable. The gentlemen present offered many valuable suggestions in return for the courtesy shown them, and one of the practical results of this conference was a recommendation duly formulated that a certain quantity of the more likely fibres should be sent to a spinner to be carted and made into yarn so as to admit of technical opinions being at a future conference pronounced on the suitability for the purpose proposed.

River-borne Trade of Assam for the quarter ending 31st March 1886.—The total value of the imports amounted to Rs. 75 77,805; and of the exports to Rs. 60,78,500. In these figures the value of treasure has, as usual, been omitted. There is an increase on the returns of the corresponding quarter of the previous year, amounting in the aggregate to 13 per cent. The increase showed itself in both imports and exports, but was confined to the Brahmaputra Valley. The traffic on the Surma fell off to a certain extent. The principal rise was in the imports up the Brahmaputra, caused by an increase in the supply of rice, metals, salt, sugar, and tobacco. The main imports of the quarter into the Brahmaputra Valley were—Metals, Rice, Opium, Cotton piece-goods (European), Sugar, Salt, Oils other than kerosine, Pulses, Liquors, Tobacco, Cotton twist and yarn (European), Ghi, Kerosine, and they were mostly from Calcutta. The imports from Northern Bengal consisted chiefly of sugar, salt, and tobacco. All these, of course, came up the river in boats. Pulses came mainly from Calcutta, and steamers brought up 61 per cent. of the total supply. Compared with the corresponding quarter of 1885, the trade in all the articles enumerated above with the exception of opium and cotton-twist and yarn, exhibited an improvement. The traffic in cotton-twist and yarn fell off slightly, but the quantities were small. In point of value, tea, as usual, stands first amongst the exports from the Brahmaputra Valley, though the figures for the quarter show less than one-fourth of the trade of the three months immediately preceding. This is natural, as there is no manufacture during the period in question, and nearly the whole of the quantity prepared during the season of 1885 was despatched before January 1st 1886. The most important articles exported during the quarter under report are named below:—Tea, Mustard, Jute raw, Lac, Timber, Cotton raw, Tea-seed, Coal, Rubber, Til, Cocoons, and Paddy. Compared with the corresponding quarter of 1885, the only article which showed a considerable falling off was paddy. The traffic in rubber, sticklac, *til*, and timber also declined, but only slightly. All other articles enumerated above exhibited a quickening of trade, the greatest rise being in jute, mustard, cotton, and coal.

The imports to the Surma Valley consisted principally of the following:—Cotton piece-goods (European), Metals, Sugar, Salt, Spices, Pulses, Tobacco, Liquors, Kerosine, and Other oils. Compared with the corresponding quarter of the previous year, there was an increase in the imports of pulses, metals, and undrained sugar, but a decrease under all the other heads enumerated above. Amongst the exports of the quarter, tea is, as usual, much the most valuable, but in point of weight lime stands first, the exports of the latter during the quarter under review being nearly double those of the corresponding period of the previous year. The early setting in of the dry season and consequent want of water in the hill streams that come down from the Khasi Hills

prevented the taking out of much quarried stone in the last quarter of 1885, and this most probably stimulated artificially the trade during the quarter under review. All other heads exhibit a decrease, especially oranges and paddy. The last season was not a good one for oranges, and the exports naturally fell off. The following statement shows the main exports of the quarter :—Tea, Paddy, Lime, Oranges, Hides, and Dry-fish.

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THE CALCUTTA BOTANICAL GARDENS.—This is one of the best Gardens in the world and under the management of Dr King. the able Superintendent, is extending its useful sphere of action year by year. The paper mulberry which supplies the materials from which the *tappa* cloth of Polynesia and the bulk of the paper of China and Japan are manufactured, was thought by him suitable for growth in the odd scraps of ground which are so numerous round the villages of Bengal. A year's further experience confirmed the belief that the tree was perfectly at home in this part of the country, and that there was no reason why this hope should not be ultimately fulfilled. The oldest trees in the Botanical Garden (now about four years old) are thirty feet high; they yield seed freely, and send up numerous shoots from their roots, provided the latter be cut under ground by the free use of the hoe in the neighbourhood of the tree. The Japanese cultivate the plant very much in the same way that osiers are grown in England, and for paper manufacture they use only the young shoots. This is a kind of cultivation especially suited for waste nooks and corners in Bengal. And as the bark has been pronounced by English paper-makers to be nearly, if not quite, the best of paper fibres, the cultivation seems to offer encouraging prospects. The bark is of a very white colour; it yields about 58 per cent. of bleached fibre, and requires very little bleaching. The utilisation of the fibre of the common plantain, seems at last to have been brought within the range of possibility by the invention, by a retired officer of the Madras Army, of a simple, portable, and withal very simple machine. This machine is now being patented, and, if it answers as well as it appears to promise, a great step will have been gained in turning to account an immense amount of useful fibre which is at present hopelessly wasted.

MANGOES PEST.—A ripe mangoe, otherwise very handsome and having no perforation or mark on its skin, when cut through, is seen to be bored by the grub of an insect, the grub either living or dead. It appears that insects lay their eggs inside the flowers when the trees are in full blossom and that these eggs develope into grubs with the development of the fruit. A few years back no such pest was known in Bengal excepting in a few districts and its sudden expansion almost all over Bengal seems to us of more serious import than is generally believed. Any one acquainted with the ravages of *phylloxera* on vines must not fail to sound a note of warning to arrest the pest if possible at its beginning, or, otherwise the mangoe plantations of Bengal may not unlikely suffer the fate of the vinyards of the south of France, where the cultivators have now been obliged to forsake vine growing for some other more safe crop. To strike the evil at its root, the life history of the pest will have to be thoroughly made out. The grub will have to be reared and watched in order to find out what mature fly it develope into. It will have also to be known what are the favourite resorts of these mature flies and whether it would not be possible to destroy those places of resort and thereby destroy them or at any rate drive them to a safe distance. Most of our readers are perhaps aware that the removal of barberry plants from hedges was known by English farmers to have perceptible effects in diminishing wheat rust, even before Botanists succeeded in tracing out the connection between the barberry leaf and the wheat rust. It is not unlikely then that the jungly shrubs which abound in the neighbourhood of most of our mangoe topes harbour these insects during the time that the mangoe trees are not in flower, and, if it be so, to destroy those shrubs might have the effect of diminishing, if not entirely eradicating, the pest. The other day we had a talk on the subject with the owner of an extensive mangoe plantation of 24-Pergunnahs who seemed to have been in great trouble about it. He informed us that just as flowers begin to open insects are seen to crawl in numbers up the trunks and he believes that these hibernate at other times under the earth. He had the earth under some mangoe trees dug up and thoroughly worked to a great depth and he says it had the effect of reducing the pest in those trees next season. The Agricultural Department in Bengal, if it wants to do some practical good to the country, should at once institute a series of investigation on the subject.

AGRI-HORTICULTURAL SOCIETY OF INDIA—It might interest many to read the following extract from the June proceeding of the above society on

mangoe pest. Mr. W. Gollan, from Shaharunpur writes, I have taken the liberty of sending you a small bottle containing an insect which is very destructive to mangoe blossoms in this part of India. We had a splendid show of flowers this season but the crop of fruit is comparatively light. We had no rain or storms to interfere with fecundation when the trees were in flower, and as these insects were to be found on them in millions, I have no doubt their presence was the cause of our light mangoe crop. They appear to subsist on the juices of the leaves and flowers, and particularly on the pollen of the anther-bearing flowers. I have also sent some leaves covered by galls in which the insect is developed. The dry empty galls appear to be those from which the perfect insect of this season issued; and the green entire galls appear to be those in which the insect is being developed for next season's work. As this insect may have been previously brought to notice by members of your Society, I will feel greatly obliged if you will put me in the way of obtaining any published information you may know of regarding it. I also wish to know remedy for its destruction. I have tried several experiments, but have not hit on anything that is effective for its destruction. Washing and rubbing the galls of each leaf by hand with an insecticide would no doubt prove effective, but that is out of the question on a large scale. If you do not know anything regarding its history, it might do some good by bringing it to notice at the next Meeting of your Society. Mr. Gollan was communicated with, and the following is his reply:—You cannot do better than bring the insect of which I sent you specimens prominently before the public. I confess to knowing little or nothing about it, but I intend watching it closely in future, and if all who are interested do the same, we ought at least to find out its life history, and some one may alight on a point from which it can be successfully attacked. Since writing my last letter, I remember of reading an article on 'Jamaica' some years ago in a periodical (I think the *Gardener's Chronicle*) in which it was stated that the negroes had a habit of collecting large heaps of rubbish on the windward side of their mangoe plantations, while the mangoes were in flower, and setting fire to it in order to drive away pollen-eating insects by the smoke thus caused. Our pest may not be a pollen-feeder, but there are such insects in this country. There is a minute black fly which is very fond of the pollen of the Amaryllis. I can cite an instance. I have had hundreds of Amaryllis flowers open at one time, and have often had difficulty in finding sufficient pollen to hybridise the open flowers. The anthers of the Amaryllis burst in the evening and early morning and when I have neglected to go over the flowers before 10 A. M., I have often been unable to find a single anther with good pollen in some hundreds of flowers. Some days there are exceptions, but these, as a rule, occur early in the season before the insects are numerous. It might be worth trying the effect of smoke on such insects. I have no faith in it doing any harm to our mangoe pest but if persisted in, it might help them off until the fruit has set. I have never noticed the insect you find in the ripe mangoe fruit in Bengal. If it exists here it is in limited numbers. I will, however, keep a sharp look-out for it this season, and will communicate the result of my observations. The insect refered to in Mr. Gollan's letter, as found in Bengal, has for some years been increasing in numbers and spreading into districts where it was previously unknown. This is, perhaps, aggravated by the custom of sending presents of fruit, sometimes long distances. The beetle appears in the fruit when it is cut, there being seldom any outward mark to betray its presence. it is generally found in only one-half of the fruit. In some places few mangoes escape its attacks. This year there seems to be a marked decrease in its appearance; specimens of the beetle will be sent to England for examination by specialists; and by the courtesy of Mr. Uleth, the Superintendent of the P. and O. S. N. Company, some fruit known to be attacked by beetles will be sent in the refrigerating room of one of the P. and O. steamers so that traces of the insertion of the eggs &c., may be looked for, as this may assist in the finding of a possible remedy.

Worms in domesticated Animals.—Worms of various sorts inhabit the intestinal canal and other organs of digestion, and induce irritation, which is often associated with diarrhœa and general unthriftiness. Horses, cattle, and sheep are victims, in different degrees, to the ravages of parasites. It is only necessary to allude to tape-worms in lambs, and the destructive fluke-disease, to show that internal worms have much to answer for in the matter of disorders of the digestive system. It may, however, be remarked that for horses a general and effective worm-killer is to be found in the agent santonine, which may be given in doses of 15 grains in a ball with three drachms of aloes, and repeated in a few days, if necessary, while for worms in the digestive organs of sheep, no remedy has yet been found which equals in efficacy common salt. Powdered charcoal has recently been advocated, and being a harmless agent,

is worthy of fair trial. Common salt has also been found to be an effective worm-killer in cattle.

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CONSUMPTION OF TEA.—It is not known when tea first became an article of diet but its properties quickly received recognition in China, and a thousand years ago it had become the national beverage there. Early in the seventeenth century tea was introduced into Europe by a Dutch company. It gradually gained ground, and in the domestic history of England there is nothing more remarkable than the hold which tea has taken of the people. A hundred years ago 18,000,000 lbs of tea came to Europe, of which two-thirds was taken by Great Britain. Every reduction of duty in England was accompanied by a proportionate increase in the consumption, so that in 1845, when a further reduction of duty was contemplated, Parliament was informed on high official authority that, the imports of tea having reached 40,000,000 lbs. it was probable that the limit of consumption had been touched, and that a fresh reduction could only be followed by a loss of revenue. That was in 1845, and, though there was now a tax of 6*d.* per lb. on tea, equal to an *ad valorem* duty of more than 50 per cent., the consumption in 1885 was 180,000,000 lbs., or within a fraction of 5 lbs. per head of population. What but a few years ago was ...ed as a luxury by a few, had become an article of daily consumption in almost every household in the kingdom. The discovery that the tea plant was indigenous in the Indian forests was made sixty-five years back, and a committee was soon afterwards appointed to consider the best methods of cultivating the plant in India. Great difficulties were encountered, many of them being placed in the way by the Chinese; but gardens were formed, the enterprise grew, and British-grown teas, which in 1865 formed but 3 per cent. of the total quantity consumed in the United Kingdom, amounted to 16 per cent. in 1875, and to 38 per cent. in 1885. India has 250,000 acres under tea cultivation, and produces 70,000,000 lbs. of tea, the capital invested in the industry is £16,000,000; and a quarter of a million of Her Majesty's subjects, who indirectly contribute to the income tax of Great Britain, are engaged in it. The tea plant was introduced to Ceylon from China about the year 1842, but it was not till coffee was stricken by disease that attention was generally directed to the cultivation of tea in Ceylon. In 1873 a small parcel of 23 lbs. of tea was exported from Ceylon. This year 9,000,000 lbs would be exported, and, estimating from the acreage now planted with tea, the exports in 1890 would be 40,000,000 lbs. There were 120,000 acres planted with tea, which gave employment, to a considerable number of Britons and 150,000 British subjects, and the area was being rapidly increased. The cultivation of tea had been successful in Natal, and a large quantity of land was being taken up for that purpose. The teas of Natal, as well as those of Fiji, would eventually find a market in Australia, but it was to India and Ceylon that the people of England must look for a pure tea produced by their own fellow-subjects. The people of the Australian colonies are the greatest consumers of tea in proportion to the population. The consumption per head of the population is as under:—Australian colonies, 7·66 lbs.; New Zeland, 7·23; Great Britain 4·90 lbs.; Newfoundland, Canada, and Tasmania followed closely; various British possessions, 1·60; the United States, 1·30; Holland, the largest European consumer next to Great Britain, 1·05. In Spain, which was lowest on the list, the consumption was only ·01 lbs.; in other words, the Englishman drinks 490 cups of tea for every cup taken by the Spaniard. It is not generally known that tea is really a forest tree and not a bush. In their natural state in the Indian forests, some of the tea trees are fifty feet high. With regard to the controversy as to whether tea is damaged by lead in the boxes Dr. Watt, the specialist of the Revenue and Agricultural Department, Government of India, is of opinion that the fault is to be found in an imperfect knowledge of the fermentation of tea before packing. Instances are known of teas having been tainted though the lead was not perforated. Our readers are perhaps aware that in England there is a duty of 6*d* per pound of tea and the British philanthropists are now engaged in setting up an agitation against taxing an article of every day use. We should only remind them of the immensely poorer ryots of India who have to pay tax on salt, an article of diet which no one however poor can do without.

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IMPROVED PLOUGHS IN BENGAL.—Cast-iron and wrought-iron ploughs are now being made at Barrakur and Sibpore in accordance with instructions from Mr. A. C. Sen, C. S., and other officers of the Bengal Agricultural Department, aided by Ritter von Schwarz, the Superintendent of the Burrakur Iron Works. Total cost of the cast-iron plough in one piece inclusive of wooden handle and pole is, Rs. 2-10 if ordered by the hundred, and Rs. 2-12 if ordered in numbers less then one hundred, and of the plough in two pieces Rs. 3-4 and Rs. 3-8 respectively. More than four hundred of the cast-iron ploughs have already been bought by ryots in the neighbourhood of Burrakur who have seen them used, and have paid for them at higher rates than those at which it is

now found possible to sell them. They may be worked by an ordinary ploughman with ordinary bullocks, and no special instructions regarding their use are required. The iron parts of the same plough can for the present be supplied from the work-shops at Sibpore, made of wrought-iron with the cutting edge of steel, at Rs. 3-8. As pointed out by Ritter von Schwarz, cast-iron is preferred to wrought-iron or steel for construction of ploughs in parts of Germany and in the United States. It has a great advantage over wrought-iron in point of cost, but, on the other hand, cast-iron ploughs once broken, cannot be repaired by a village blacksmith, as those made of wrought-iron can. Another plough consisting entirely of wrought-iron, has been made for Mr. Hossein in Bhagulpore and found there to be useful. The price of this plough which can also for the present be supplied from the Sibpore workshops, is Rs. 6, but it can, it is stated, be made by a common blacksmith in Bhagulpore at Rs. 5. The advantages these ploughs are supposed to have are *first*, that by the use of these improved ploughs a great and obvious saving in labour is affected, inasmuch as they turn over the soil to a breadth of six inches, and make a furrow to a depth of four inches, instead of merely scratching a line as the ordinary plough does. *Second*, that by the use of these improved ploughs, and there is reason to believe on principle, and also from the recorded results of long-continued experiments in the North-Western Provinces and elsewhere, that this mere inversion of the soil, by exposing it to the action of the air, *if the ploughing is effected some time before the crop is sown*, gives a largely increased yield as compared with the yield of the same soil when scrubbed with the ordinary plough. *Third*, these improved ploughs while being simple of construction, substantial and efficient, have at the same time the great advantage of being so cheap as to be within the reach of any ordinary cultivator's means—a fact which is shown by the circumstance that they have been eagerly bought up by many ryots in the neighbourhood of Burrakur who have seen them worked. It will probably be found that neither these nor any other plough will be found to suit the requirements of all parts of a country with conditions of soil and cultivation so widely diversified as Bengal; but there is no reason why improvements on the present ploughs, or why entirely new ploughs to suit the requirements of various parts of the country, should not be made at a very moderate cost, in accordance with suggestions from any private individual or public officer, and sold at the lowest price which one may find to be profitable.

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TRADE OF INDIA FOR APRIL AND MAY 1886.—The total value of imports excluding treasure and Government store amounted to Rs 9,45 55,736 and exports to Rs. 17 97 94,063. On both the counts there has been some improvement compared with the trade of the corresponding period of last year. Under exports there is an increase of over a crore and seventy-five lacs and under exports nearly the same amount. This confirms the general impression that signs are already visible of the revival of trade which had hitherto been suffering from depression. As regards imports the increase has been most under manufactured articles such as yarns and textile fabrics, and the decrease most under railway plant and rolling stock; while with exports, the increase was most under articles of food and drink and the decrease most under manufactured articles and oils To show our dependence on foreign countries for articles of every day use, let us inform our readers that during two months April and May, we imported no less than 5 crores rupees worth of cotton goods, which is about 2 crores rupees more than what we had imported during the same period last year. Amongst other articles of import, we might mention kerosine oil (Rs. 11,94,071). aniline dyes (Rs. 2,39,844), ivory (Rs. 4,69,113), raw silk (Rs. 7,06,623), silk manufactures (Rs 23,87,758), leather boots and shoes (Rs 1,94,205), matches (Rs 3,09 554), soaps (Rs. 1,49,594), umbrellas (Rs 5,49,404), and candles (Rs. 1,80,467). Under exports the larger items are rice (Rs 1 75,31,345), wheat (Rs 2,06,15,487), opium (Rs 2,02,24,910), and cotton (Rs 4,53,32,488).

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STOCK OF WHEAT IN THE WORLD—There is every reason to expect that the year 1886 will have to be counted among the lean years. More than this, it will be a lean year for the world as a whole. Certainly the world's wheat crop will be much below average. In England, France, Holland. Denmark, and South Russia, there can scarcely be a doubt upon the subject. In America, where prospects a little time back were described as full of promise, the winter and spring wheat crops together will probably be barely an average, if not considerably below, as may be judged from a report in another column. The spring wheat crop has suffered seriously in some States, and the winter crop had previously been discounted from a "bumper" crop to an average one. Reports published last month about our own continent show that the wheat crop here is much smaller than that of last year, and it is well known that the Australian, New Zealand, and South American crops were extensively deficient. Will the price of wheat rise, then? Is

ought to have risen long ago, if the probabilities of future supplies had ruled the markets.

The estimate of stocks on hand in the United States on May 1, is as follows:—

Year	Farmers, Stocks. Bushels	Commercial Stocks. Bushels	Aggregate Stocks. Bushels
1886 ...	60,000,000	44,000,000,	194,000,000

The natural requirements for consumption and the actual exports (including flour as wheat) in the United States are as follows:—

Year.	Consumption. Bushels	Exportation. Bushels	Aggregate Bushels
1886 ...	84,000,000	20,000,000	104,000,000

The estimated acreage of winter wheat now growing, and of spring wheat sown, or to be sown, (the latter from data not yet sufficiently full to determine with decision) is given as follows:—1886, winter 24,727,087; spring, 11,800,000; total, 36,527,087 The requirements of present consumption will be met by a breadth of 27,000 000 acres, if the yield shall prove an average, leaving about 9,500,000 acres for the production of wheat for export, sufficient to produce, with an average yield, 114,000,000 bushels A large yield, like that of 1884, would allow 150,000,000 bushels for exportation The average production of Europe from 1874 to 1881 is 1,144,000,000 bushels; the consumption for food and seed 1,312,000,000 bushels, leaving a deficiency of 168,000,000 bushels. The consumption per head for food and seed averaged very nearly four bushels, varying from a single bushel in Norway to nine bushels in France. The yield for the last five years has been larger than for eight years preceding, and is now 1,218,000,000 bushels, on increase of 74,000,000 bushels. The rate of consumption on total population has slightly increased. The stocks on hand in Great Britain of both wheat and corn, April 1, for the last five years have been as follows (in Liverpool, London, Fleetwood, Gloucester, Bristol, Hull, Newcastle, West Hartlepool, Glasgow, and Dublin), calculated in Winchester bushels:—

Years.	Wheat.
1886	14,146 265
1885	8,164,794
1884	17,031,889
1883	10 310,975
1882	7,950,065

Stocks of wheat in Paris at the same date in 1886 slightly exceeded 3,000,000 bushels. They were about 3,000,000 bushels April 1, 1885, and nearly 5,000,000 bushels April 1, 1884. Records of other Continental markets are not complete, but stocks are generally small and differ but little in quantity from those of a year ago. The supply of the commercial year 1886-7 is to come from the crops already harvested in the southern hemisphere and in India, and those to be harvested during the next four months. The crop of India, grown on an area reduced about one and three-fourths million acres, may have yielded 265,000,000 bushels. The Australasian crops are greatly reduced, and from present information, will not exceed 22,000,000 bushels. Those of South America are somewhat larger than last year; how much is not yet known, but are not likely to increase their usual product more than 5,000,000 bushels. From present information, it is fair to estimate a decrease of 32,000,000 bushels from the aggregate of last year's production in the districts already harvested. With a continuance of the present conditions, the English crop will be about 465,000,000 bushels. The area of wheat in Great Britain has been reduced 8 to 10 per cent. The averages of yield in Austria Hungary, France, Germany, Great Britain and Ireland, and Netherlands range from 16 bushels in Austria-Hungary to 28 in Great Britain, and the average of all for five years is nearly 15 bushels. Russia has an area of nearly 31,000,000 acres, and yields scarcely eight bushels per acre. Other countries have an aggregate of about 29,000 000 acres, and produce an average of 11 or 12 bushels per acre. The area planted in wheat and now harvested or growing is probably very nearly as follows:—

Divisions.	Acres.
Europe	94,000,000
North America	40 500,000
South America	6,000,000
India	26,000,000
Australasia	3,500,000
Africa and Western Asia ...	13,000,000
Total ...	183,000,000

SILK IN BRITISH BURMA.—Silk-growing is a profitable industry in British Burma and is mostly limited as in Bengal to the peasantry of the country. The chief seats of this industry are at present in Tharrawaddy, Prome, Thayetmyo, and Toungoo. The occupation of breeding is mainly confined to the higher latitudes of the country, on the slopes of the Pegu and Arakan Yomas. But spinners and weavers are found

in other places than those mentioned above. There are many species of silk-producing insects of which three are well known. One domesticated which feeds on the leaves of the mulberry plant and two wild which feed on the leaves of trees and plants which grow wild in the jungles. The domesticated worm is *Bombyx arakanensis* and the other two worms are *Cricula trifenestrata* and *Attacus atlas*. The domesticated worm, its cultivation, and manufacture of silk from the cocoons are thus described. The local worm is multivoltine, that is to say, it spins a number of times during the year; and it is the most prolific of known varieties as it completes a cycle of its existence in from 32 to 43 days, thus :—

In the egg state ...	...	8	days
In the worm state ...	...	15 to 23	"
In the cocoon state ...	...	8 to 10	"
In the moth state ...	...	1 to 2	"
	Total ...	32 to 43	days

It takes the female moth one or two days to deposit all her eggs, which average from 200 to 250. The pieces of cloth on which the eggs are laid are put away till the sixth day, when they are taken out and inspected. By this time the worms have matured in the ova, which has changed colour from white, then to deep yellow, and finally to dark purplish slate. On the eighth day the worms begin to appear,—tiny, black specks. The ova cloth is then covered with tender mulberry leaves to which the worms speedily crawl. The earliest risers are considered the best worms, and the worms which do not crawl at all are considered too weak and worthless and are usually rejected. The selected ones are then kept in large circular trays, being fed in them without any change of bed and without being disturbed in the least. In these trays during all their life they moult, defecate, and here the refuse of their food accumulates till the mass attains to almost the level of the tray. By that time the worms show by their restlessness and their attempts to spin that they are "ripe", they are then picked out by the hand and deposited in the cocooning trays. These are of large size, from 3 to 4 feet in diameter, and within them is a long ribbon of plaited bamboo a couple of inches broad, wound round with the edge on the flat of the tray, in a helix or spiral. The worms are scattered over these trays by the handsful without any care or regularity, and, left to themselves, they soon begin to spin. They would form much better cocoons if a little care were taken to provide each with a separate place for cocooning. They finish the "cradle" in about six hours; in eight or ten hours the worms have disappeared from view, and in from 24 to 36 hours the cocoon is completed. In from 48 to 50 hours the last transformation is effected and then the insect sleeps for eight, sometimes, and especially in the cool weather for ten days and eventually emerges a moth. If male, he is active and restless, seeking a mate; if female, remaining quite till found by a male, whom she at once admits. The male becomes violently active if enough of the other sex are not provided, and in such case it is not unusual to find two males attached to one female. After the cocoons have matured and before the exit of the moths, they are prepared for reeling. Torn away from the cocooning-trays by handsful they are thrown into baskets, and then the women and children of the family divest the "pods" of all their "waste" or floss. Then, without sorting or selection of any kind, except that the yellow and white "pods" are kept apart, the cocoons are put into a chattie, or earthen pot of water and slowly simmered over a fire. The reeler, generally a woman, who makes it her sole business to reel silk, tries the pods after they have simmered for a while, and as soon as she finds the fibre come away easily, she picks up a handful of cocoons each by a thread of silk, the number usually being from 18 to 25,—and shakes them well to a sufficient length, and runs them through a loop of brass wire on to a reel fixed to a pair of cross-sticks of bamboo. From the reel the filaments are given a slight twist and carried on to a cylinder of wood with a handle and turning on a trestle; one woman manages the whole operation. The other parts of this question are reserved for the next issue.

1. List of Agricultural implements experimented in the Lower Provinces in 1885-86. From the Director of Agriculture, Bengal.
2. Transaction of the Highland and Agricultural Society of Scotland, Fourth Series, VOL. XVIII: From The Secretary.
3. Report on the River-borne Trade of Assam for the Quarter ending 31st March 1886: From Secretary, Chief Commissioner, Assam.
4. Annual Report of the Calcutta Botanical Garden: From Government of India.
5. Review of the Reports on the Estate under Government management in the Central Provinces: From the Commissioner, Central Provinces.
6. Report on the Trade between Assam and the adjoining foreign countries for the year 1885-86: From Assam Government.
7. Report by Mr. H. Clave on tobacco cultivation as pursued in Lower Burma and Java: From Government of India.
8. Memorandum on the Prospects of the Wheat crop in the Punjab: From the Government of India.

Thanks of the Editor are recorded for the above contributions.

THE CULTIVATION OF SUGARCANE AND PREPARATION OF SUGAR IN POONA.

(continued from the last number.)

The Cost of Irrigating from Wells.

Assuming the average watering to be 80 tons per acre, the cost of lifting water 25 feet to be 1 anna, per 1000 gallons, and the yearly number of waterings 30, the cost of raising the water is equal to Rs. 33-9-7 (80 tons = 17920 gallons = 17·920annas × 30 = Rs. 33·6). The Irrigation Department charges Rs. 25 per acre but the difference is counterbalanced by the advantage of having bullocks feeding on the spot. The cost of conducting the water in the fields is Rs. 23 per acre in both cases.

The System of conducting the Water in the Fields.

The system of conducting the water in the fields at present employed is the old fashion that was suitable when the water was drawn from wells by four bullocks. In this system the waterman opens a small channel into a bed about 10′ × 10′ when this is watered another is opened and the labourer must work hard to water ¾ of an acre daily, and as a supply is obtainable generally only 4 days out of 7, one waterman can water only 3 acres.

Unfortunately the canal outlets are made to suit this old fashioned state of affairs but no doubt would be altered by the Irrigation Department if desired.

If the land is nearly level, beds 66′ × 66′ would be a suitable size, one man could attend to ten such beds at once and water about 4 acres daily. The profits on Agriculture are extremely low and it is only by gathering up loose threads of expenditure such as this that the cultivator will manage to keep afloat respectably.

Sewage Irrigation] is not carried on near Poona because the necessary appliances have not been provided. Would it be profitable to use sewage, is an interesting question ?

The Composition of Sewage is well known to vary greatly but the following analysis representing only what is known to be valuable in manure extracted from Mc. Connels Agricultural Note Book may well be taken as an average example.

Ten tons of Sewage have been found to contain-

In solution	Nitrogen	1·6	= 4·2 lbs.
	Sodic salts		
	Potassic salt	0·5	
	Phosphoric acid	0·4	
In suspension	Organic Compounds	1·4	= 1·9
	Nitrogen	0·3	
	Calcic Phosphate	0·2	

Total valuable constituents 6·1 lbs. (excepting water) per 10 tons.

Assuming the quantity of sewage required to be 200 tons per acre monthly and that irrigation water is given during 9 months, we have 6·1 lbs. of valuable matter in 10 tons and sewage 1800 tons, the year's supply per acre.

tons tons

10 : 1800 :: 6·1 : 1098 lbs. per acre of valuable matter in the quantity of sewage required to water an acre of sugarcane for one year.

How much of this Valuable Matter is there in the quantity of manure the cultivator wears the life out of his bullocks in hauling to his fields ? We are told on most reliable authority that 1 ton of farm-yard manure contains only 30 lbs. of this valuable matter. In fact the cultivator might carry in one hand all that is good in three of his cart loads of muck. The cultivator knows that 20 tons of Farm yard manure is sufficient for an acre of sugarcane.

30 lbs. being the quantity of valuable matter in one ton of manure and 20 tons the quantity required per acre, 600 lbs. will be the valuable matter in the quantity of manure required against 1098 lbs. in the quantity of sewage required.

An allowance must be made for valuable matter brought by the Irrigation water, for which 10% will be ample. Therefore we have 660 against 1098.

Or the quantity of manure contained in average sewage is nearly one half more than the cultivator at present applies to the land to grow Sugarcane.

If the cultivator pays Rs. 4 per ton for 20 tons of manure laid down in his fields and Rs25 for Irrigation water, in total Rs 105, surely he could pay Rs 75 per acre for sewage. The Poona Municipality would doubtless get the same quantity of water for Rs 25 and the difference between the value of the water at its entrance and its exit as sewage would be sufficient to pay for expensive sewers.

But a sewage farm concentrating the sewage on a limited area would not be desirable. For sanitary and financial reason, the sewage should be as widely distributed as the same quantity of ordinary irrigation

water would be. About two months after planting the canes are about 1½ feet high and it is time to earth up. If the manuring was insufficient at the ploughing time the want is made up now. On Moorum (rough sandy) soils, it is advisable to give a part of the manure at this time but on deep loam which has great retaining power, it is more profitable to cart all the manure on to the ground at once, because a great deal of manual labour and treading of the soil is saved. In earthing up, the ridges are split with the hoe and the soil drawn towards the plants, all weeds and dead leaves being removed at the same time.

The weeding must be repeated two or three times before the cane covers the soil and keeps down weeds by the shade it causes. After this there is nothing to do but water and look after vermin and the condition of the fences until the cane is ripe.

TRASHING] The well known West Indian operation called Trashing or removing the dead leaves from the cane during its growth, can scarcely be said to be practised here. The removal of a few dead leaves while weeding is going on which obtains here, is not the careful trashing which the cane undergoes in the West Indies and some parts of the Concan.

The idea of removing such leaves is strongly condemned by the cultivators here, who say the stem becomes red and dries up. That the stem becomes red is easily proved, but that the cane dries up or is in any way injured for sugar-making is very doubtful. Cane that had been thoroughly trashed, burned to bright red, and, according to the sugarboiler, thoroughly spoiled, gave on experiment here 66% of juice which in its turn gave 15% of Gool much superior to the average of the field and 1½% more Gool than untrashed cane gave.

The trashing with inexperienced hands was found very expensive and the most serious effect of the operation observed was a considerable increase in the labour bill, and it will be admitted that in these days of low prices such an effect must be avoided by all means. That the operation is unprofitable in this district is no doubt to be attributed to the dry climate. The effect of long continued rain on canes laden with dead leave must be to beat them down, which will restrain the flow of the sap and prevent a due share of light reaching some of the canes with the inevitable effect of an increase in the inverted sugar or treacle.

IS SUGAR-CANE AN EXHAUSTIVE CROP.] For convenience in considering this question it may be assumed that an average crop is 30 tons of cane and of raw sugar 3 tons.

The raw sugar is the only part which should be carried away and practically it is so. Although it may take the silica left in the ashes of the crushed cane a ong time to return to its soluable condition, yet in good soils that ingredient is set free as fast as it is wanted but whether it is really necessary is doubtful.

The same crop in different soils or different varieties of the same crop have such a varying proportion of silica that it may safely be left out of consideration.

The average of a large number of Raw Sugar analysis as given in Spon's Dictionary is :—

	%
Crystallisable sugar	88·01
Uncrystallisable do.	3·94
Ash	1·18
Moisture...	3·64
Organic-matter not sugar	3·16

The average of Dr. Stenhouse's twelve analyses on sugar-cane ash is nearly

Silica	42.0
Phosphoric acid	6·48
Sulphuric acid	6·62
Lime	8·38
Magnesia	6·62
Potash	15·00
Soda	1·2
Chloride of Potassium	8·34
Do Sodium	5·44

Cane Sugar ash has been found to consist of

Potash	28·79
Soda	0·87
Lime	8·83
Magnesia	2·83
Ferric Oxide and Alumina...	6·90
Sulphuric anhydride	42·65
Sand and silica	8·29

The ash being 1·18 % of 30 tons = 793 lbs. nearly per acre. The weight of the ingredients of the ash required per acre may be compared with other crops as given in Mc. Connel's Agricultural Note-book in pounds per acre.

Crop	Weight of crop		Total pure ash	Nitrogen	Sulphur	Potash	Soda	Lime	Magnesia	Phosphoric acid	Chlorine	Silica
	At harvest	Dry										
Sugar-cane	30 tons	Sugar 3 tons	793 lbs.	369·6	52·49	150·95	24·88	66·45	52·49	51·38	61·16	333·06
Mangelsroots 22 tons	49280 lbs.	5628	410	96	4·9	161·1	75·4	24·2	19·7	34·0	40·6	16.4
Leaf	18233	1654	280	51	9·1	71·4	65·2	29·1	27·2	15·1	49·8	9·2
	67573	7282	690	147	14·0	262·5	140·6	53·3	46·9	49·1	90·4	25·6
Meadow Hay 1½ ton	3360	2822	208	49	5·7	56·3	11·9	28·1	1·1	12·7	16·2	57·5
Wheat grain 30 bush	1800	1530	31	33	2·7	9·7	0·9	1·0	3·7	14·3	0·2	0·5
Straw	3158	2653	158	12	5·1	18·2	2·5	9·2	4·0	8·0	1·7	110·6
	4958	4183	189	45	7·8	27·9	3·4	10·2	7·7	22·7	1·9	111·1

From a careful examination of these figures, it appears that although the produce is heavy and the quantity of ash taken from the soil is absolutely great, yet, comparatively, it is not an exhausting crop. It takes up much less phosphoric acid per ton of produce than any of the three crops it is compared with. The Nitrogen abstracted is in a great measure retained on the spot in the skimmings and care must be given to return that matter to the soil without waste. The potash taken away from the soil is comperatively low in quantity.

The silica is absolutely high and repeated cropping with cane may require caustic lime to assist in making sufficient soluble silica available, but practically this condition is not met with. And it is questionable whether silica is essential. We are then reduced to Nitrogen, Phosphoric acid and Potash as the necessary manure and this we have in the ashes of our furnaces and crushed bones. Would it not pay to burn the bones? If any other cheap source of Nitrogen was available it possibly might, but practically we have no other source until Sulphuric acid becomes cheap. Then we may calcine the bones in an apparatus arranged to fix the ammonia.

Catch crops.] This term may be applied to the subsidiary crops grown while the main crop is young and does not occupy all the ground. Formerly a great variety of petty crops were grown in this way. The cultivator's wife would drop in seeds of Bendy (Hibiscus esculentus), Cakri (cucumis sativa), Moola (Raphanus sativus), Chowlee (Dolichos sinensis), yerendi (Ricinus communis) and the seeds of shevri (Sesbania Ægyptica)* which came in the manure would be allowed to grow and the produce carried to market daily. This is an expedient for saving capital and for the poor cultivator near a ready market, it is very good practice but if the cultivator can let the amount spent in manure and labour lie out at interest in the growing crop until the sugar comes to market, the probabilities are in favour of a higher profit on the whole than if he had taken his interest piecemeal.

The sugarcane growers who have gone into the business lately and are not regular cultivators appear to be far more successful than the ordinary cultivator and they take no catch crops and permit no weeds such as shevri or yerandi to appear in their fields.

Rotation, or the growing of different crops one after another which are known to remove different proportions of the ingredients of the soil that are present in low quantities yet are essential to healthy growth is well understood by the cultivators near Poona. It is a simple question whether it is more profitable to buy more manure and grow cane or to grow a rotation crop which will be deeper rooted and take up a different proportion of the scarce ingredients of the soil, thereby preserving its natural fertility. The Poona cane grower when he cultivates a deep loamy soil has settled the question for himself to be cane after cane and he is right.

Lawes has proved experimentally what every true observer devoted to the subject must have known previously that it is impossible to utterly ruin a soil by cropping it with the same plant repeatedly. A stage can soon

be reached at which other things being equal the produce becomes stationary. This is in fact the condition of immense tracts of soil in this country. Whether that quantity of produce is one which will pay the cost of cultivation is a local question and does not affect the general principle. As has been said the cultivator of a deep loamy soil near Poona finds it more profitable to buy manure and grow cane year after year but on thin trap soil which under irrigation yields heavy crops of cane for a few years, it is found more profitable to grow Bajree (Penicillaria spicata), Chillies (Capsicum annum), Teel (Sesamun Indicum), Karala (Verbesina sativa), for a few years than to buy the quantity of manure necessary for cane. On rich loamy soils it is quite possible to keep cane growing continuously from the same stools 3 or 4 years and a second year's crop called "Khorawa" is common; but the system needs much manual labour in digging between the stools and in carrying manure on to the land in baskets. Therefore it is not adopted by the more advanced cultivators who prefer to plant cane in February and March, reap the following year in April and May, sow Bajeree (Penicillaria spicata) in July, reap in September-October then begin to prepare for sugarcane again. It is a pity that Bajeree, a cereal crop drawing heavily on the soluble silicates, should be generally sown to follow cane, but there is no other crop that fits in as well as it does. Cucumbers or white Peas can be grown on such land during the rainy season, but those crops are in limited demand. Toor (Cajanas Indicus) grows well at this season, but it does not bear much seed during the short time it can be left on the ground. How would it do to sow thickly, cut green, and dry for forage? The same might be done with Gowaree (Cyamopsis psoraloides).

DISEASES.] The variety of cane grown here ('Poonda') is a thoroughly healthy plant, growing well when provided with what is obviously necessary and little subject to disease. 'Rust' attacks the cane at times and injures it as a source of sugar, but its effects are only to be seen where an excessive quantity of nitrogenous manure and a limited supply of water occur. Frequently when the supply of water is abundant the level of the land is such that extra care is required to prevent it from running off the surface and if the waterman is negligent in such a position, 'rust' will make sufficient progress to seriously injure the cane. The means of prevention are therefore obvious. Cure is perhaps impossible.

PEST.] Rats, Pigs and Jackals are serious enemies but there is one consolation, these vermin make excellent manure. A little white arsenic mixed with Gool and bread-crumb is a perfect cure.

White ants will attack the cane if the soil has been allowed to become too dry and a part of the cane has died, prevention is certainly more easy than cure in this case.

The writer has had long experience in dealing with white ants and plants and believes the want of water is more often the cause of mischief than the presence of white ants. That in fact the white ants attack the plant when a portion of it is dead from the want of water and that the ant attacks are not carried beyond the dead portion. Water alone has always been found sufficient to destroy white ants in the field when that course was thought desirable, and, in the office, water with corrosive sublimate dissolved in it is equally effective.

Soaking a variety of leaves and branches in the irrigation water is much recommended by the cultivators and it is strange that the two sorts in which most faith is placed should be members of the same family,—Asclepidæ. One sort called *jinglee sher* (Sarcostema intermedium) a plant with numerous leafless small pipe like branches is plentiful on the Deccan hills, the other is the widely spread *mudar, mandar, Rui or ak* (Calotropis gigantea) and (Calotropis procera)

A splitting of the cane which can only be ascribed to a part of the leaves being prematurely disabled from fulfilling their functions and thereby producing an undue contraction at the joint can scarcely be looked upon as a disease. It is more likely the effect of severe weather, either hot dry wind while the soil is dry or a cold blast, and may also occur from injurious substances in the soil but fortunately it is not a serious evil. A similar effect is ascribed to frost in Northern India.

TIME TO CUT THE CANE.

At from ten to fifteen months old the cane may be pressed for Sugar. No doubt twelve months old cane is the best but that time has often to yield to the exigencies of weather, labour and markets. If cut too young or too near the rainy season, it will not yield the full proportion of Sugar and the same result will be obtained if the cutting is deferred too long, because the side-shoots will start into growth and for a time reduce the quantity of sugar in the stem. By leaving it still longer however the abstracted sugar will be restored and cane which could not be cut in May can without loss be left over till November. The crop is then called 'arsalee' or ½ year's crop.

THE SYSTEM OF BRINGING IN THE CANE EMPLOYED.

During the cane season gangs of 11 men offer their services to cut, dress and press the cane, cattle to be provided by the cultivator. If the distance from the field to the mill is not more than 300 yards, the work is taken at annas 5 each man per [illegible] lbs. of raw sugar, this being the quantity they estimate to produce daily.

GATHERING THE CROP.

The cane being ready for expressing the juice, it is pulled up or broken off close to the surface of the ground, stripped of leaves, except the green tuft at the end and tied in convenient bundles by the aid of a few leaves twisted together. For market the bundles consist of 50 canes locally called *Molee*, the good ones being carefully arranged on the out side and the inside having many very inferior examples causing the weight to vary from 100 to 150 lbs. When the cane is taken to the market, it is sold at so much per *Moolee* of 50 canes, the price varies with the condition of the cane from 8 annas to Rs. 1-4-0 and the average will be found to run about Rs. 12 per ton.

If directly for the mill, the canes are not counted but only tied in convenient bundles weighing about 120 lbs. On being carried to the mill the green tuft with the upper unripe part which varies from 10°/。 to 20°/。 of the whole cane is cut off and thrown to the cattle or sent to market.

USE OF THE CANE TOP.

While doing the heavy work at the mill the cattle are fed on the cane tops only and keep in good condition, which is sufficient proof of the nutritive qualities of that food and all kinds of neat cattle are fond of it.

REPUTATION OF THE CANE TOP AS FODDER.

Still it has a reputation for causing cows to cast their calves. That the cane top has any specific effect of this kind is doubtful but, it is easy to imagine conditions in which, it would have the effect complained of. It is a sweet grass, therefore if cows are irregularly fed, they will eat of it to repletion and as it is a very coarse grass, it no doubt is difficult of digestion. Therefore if a cow having been starved for a day gets access to a large bundle of this sweet coarse grass, she will eat more than she can digest, get partly hoven and cast her calf, from the physical effect of the gas generated in her intestines, an effect to be expected from any kind of sweet green food, and not from cane tops only.

THE MILL may be started at 7 A. M and pressing 500lbs of cane per hour, enough juice to fill the pans is ready by 10 o'clock. The boiling pan is then started and the juice boiled between 4 and 5 hours. Meanwhile the men have been resting and a fresh lot of cattle will be yoked at 2 o'clock and another lot of juice expressed, this is set on at 5 and is ready by 10. At 5 o'clock the mill is started a third time and the pressing work is finished at about 8. The third lot of juice is put on the fire at 4 A. M, and is ready by 9. From this it will be seen that the men work early in the morning and late in the evening with several hours intermission at midday. While this work is going on all the hands live on the spot in temporary huts erected by themselves. The bringing in of the cane is the heaviest work as the men carry bundles (molees) of about 1cwt on their heads over a rough field; this is performed during morning or evening hours by the strongest of the men. At the mill one man called *perulia* dresses the cane by cutting off the top and cutting the cane in two if it is over four feet long. Two men feed the mill, one passing in the fresh canes is called *lawnturia*, the other gathering up the crushed pieces and passing them back through the second pair of rollers is called the *piladenara*, while two men drive the bullocks; one of the bullock drivers removes the fully crushed cane as he passes and spreads it out to dry for fuel, the other bullock driver brings a fresh lot of dressed cane every few turns.

The staff of men and bullocks required to make two pans of sugar or what in English would be called one shift is in Marathee called parak.

THE SUGAR CANE MILL USED.

A few years ago the juice was expressed by a large wooden mill consisting of three rollers held vertically in a frame and moved by two pairs of bullocks attached to a beam fixed to the central roller. This was a costly and short lived machine which creaked ominously and wasted much power in friction. Some years ago a clever mechanic of Poona, Mr. Subrao Raoji began the manufacture of mills entirely of iron which were nearly a reproduction of the old wooden mill, but the bearing parts being smaller and kept oiled, the friction is less, the machine wears longer and the work is done better. This machine can easily be taken to pieces and transported in a bullock cart; it requires no special foundation and can be set up by an unskilled labourer in an hour; by its own merits it has cleared away all opposition and now is the only sugar mill in use in this district. Subrao's mill is now made in four sizes.

No 1	with	13″	rolls	at	Rs.	300.
„ II	„	11″	„	„	„	200
„ III	„	8″	„	„	„	150
„ IV	„	4″	„	„	„	25

The size at Rs. 200 is the favourite, when worked at the ordinary pace of the bullocks, it crushes 500lbs per hour expressing from dressed cane 65% to 70% of juice, depending on the condition of the cane and shows by the dynamometre a power equal to 2 cwts used in working it. The Dynamometer occasionally for an instant runs up to 2½ cwt but generally remains at 2cwt. This mill can be hired at Re. 1 per day. While working the mill the bullocks are yoked in pairs and the immense difference in the distance walked by the outer and the inner bullock in the course of the work seems not to have occured to the cultivator. It takes

patience to teach bullocks to work singly if they have been accustomed to work in pairs but it can be done, and it is remarkable that the cultivator in this district has not found it worth his time and trouble to break in the cattle to single work.

THE FURNACE USED.

Is as rude as possible. A circular hole in the ground 6 feet diameter lined with brick serves as an ash pit; a hole left in its wall communicates with the surface by a sloping passage. The mouth of the ash pit is covered with iron plates leaving a hole in the centre about 6 inches wide. The furnace proper is the wall of the ash pit continued up two feet further. The fire door is a rude opening on the leeward side which also serves as a chimney. Near this opening the fire man sits and throws in the fuel continuously.

THE FUEL EMPLOYED.

To begin the work a quantity of dry cane leave *(Pachrood)* sufficient for two days' use is collected. As soon as the cane passes the rolls it is spread out in the sun and after a few hours drying the crushed cane "Megass" locally called *chipada* is preferred as fuel.

THE SUGAR BOILING PANS USED in this district are 6 feet in diameter and 8 inches deep and hold easily 1000 lbs. of juice.

The pans are built up of pieces of sheet iron rivetted together and strengthened by a strong rim. The usual weight of such a pan is 200 lbs. and the price about Rs. 25.

To lift the pan from the fire 4 stout iron rings are affixed to the rim through which a pair of bamboos are passed and the pan lifted by four men and the sugar runs into a cooler formed of a pan similar to the boiling pan.

DRESSING THE PAN. Before beginning to boil the cane juice, the Goolava dresses the inside of the pan with a paste prepared from cane juice and flour made by grinding the seed of Rajgira (Amaranthus paniculatus) or Ooreed (Phaseolus mungo) and a little catechu; when this is dry the pan is heated over a slow fire, then sprinkled with sweet oil and while warm rubbed with a handful of soft leaves, those of the castor oil plant (Yeredie—Ricinus communis) being preferred. The dressing is repeated about once for 12 boilings and the Goolava believes it prevents the formation of treacle or uncrystallisable sugar.

THE BOILING OF THE JUICE.

The rude furance and the sugar pan have already been described. Where the juice is brought to the pan by day, none of it will be more than four hours since it was expressed by night, not more than eight hours will have passed since the first portion of the panful of juice was expressed from the cane. In such a case acetous fermentation will not have begun and lime will not be required.

The pan is heated and the juice poured in. The poor fireman (Galiva) then has a spell of about 4 hours of very disagreeable and hot work. Sitting near to the furnace door which also acts as the chimney, he continues constantly to throw in the light fuel and keeps up a steady heat till the boiling is completed.

The Goolava does nothing during the first hour or so, The juice has been boilng since about a quarter of an hour after it was put in the pan and now presents a good coating of supernatant matter which must be skimmed off.

This is effected by a basket-work ladle which permits the syrup to run back into the pan. After one skimming the Goolava has a rest for half an hour. Then another will be required, and regular attention will be necessary because the juice is thickening and apt to boil over. If a tendency to boil over is shown the Goolava throws up small quantities with his skimmer thereby breaking the rising crust which soon sinks to its usual level.

TESTING THE SYRUP.] When the Goolava thinks the juice is boiled sufficiently, he dips his hand into water puts his fingers into the boiling juice and taking out a portion puts it into water. If the syrup mixes with the water it is not boiled enough. If the syrup collects into a ball which can be easily moulded with the fingers and is not hard, it is sufficiently boiled. The Goolava usually thinks his art a great mystery and when bystanders are looking on tries to make it as mysterious as possible but there is nothing in it that is not known to sugar boilers all over the world. Still if there is no occasion for mystery there is much room for skill. If the boiling is not done sufficiently, much syrup will drain from the lumps of gool and if over-boiled treacle or uncrystallisable sugar will be formed.

When sufficiently boiled the pan is lifted from the fire by four strong men and the syrup runs at once into another pan which acts as a cooler. Here the syrup is stirred constantly for a time, the object being to prevent the separation of the boiled syrup into two layers. It is pushed sharply from the sides to the centre so that the layers are mixed and cooling goes on steadily throughout the whole. When cooled the syrup is run into a mould large enough to contain the syrup from one pan of juice. The mould is simply a circular hole in the ground about 8 inches deep and 15 inches wide lined by a piece of stout calico. In this mould the syrup sets and by the aid of the cloth the gool can be withdrawn about 12 hours afterwards. Its future treatment is simply to turn the lump of gool (dhep) once every few days to prevent syrup from draining from it. The loose syrup will then gradually

crystalise but there is still a quantity of molasses or inverted sugar which retains the fluid form and gives the gool its clammy feeling. A pale golden colour indicates much crystalline sugar. A dark brown colour indicates much treacle. Good gool should not have more than 3 o/o of treacle in it.

If a sample of the best quality is disolved in water and reboiled with the aid of white of egg, a striking quantity of dirt will come to the surface and on standing quiet for a time a further quantity will be found at the bottom of the vessel.

The whole system of preparing sugar here is rude in the extreme and very little attention is paid to cleanliness. The wide open pans collect dead leaves and other rubbish from every passing breeze, the canes are roughly cleaned, much of the cane passes like saw dust with the juce. A rough sieve only is used to keep back large particles while pouring the juce into the pan and the skimming is not done with sufficient care. From the foregoing it is plain that there is great scope for care and skill on the part of the Sugar boiler (Goolava).

PACKING AND MARKET.

Ahmedabad is the principal market for the gool produced in this district. For transport the solid masses (Dhepa) are sown up in sack cloth or canvas and tied with Cocoa-nut fibre string.

The cost of such cloth and Cocoa fibre string sufficient to pack 1 cwt. is about 2½ annas and the packer is paid ½ anna per cwt. for his labour.

Estimate of the cost of growing sugar-cane.

Land rent	Rs. 25 per acre
Ploughing, harrowing and other preparation of the land	26 " "
Manure	120 " "
Cane Sets	30 " "
Planting, weeding and hoeing ...	12 " "
Irrigation water	25 " "
" labour	23 " "
Watching	5 " "
Fencing	5 " "
Interest on money borrowed Rs. 275 @ 10 % ...	27-8 " "
	Total Rs. 298-8 " "

the cost of growing 30 tons of cane.

Estimate of the cost of preparing 24 Pilees = 5760 lbs. + 336 lbs. (adhwa) tret = 6096 lbs (Gool) Raw sugar

10 men 16 days at 5 annas per day cutting the cane and carrying to the mill for crushing	Rs. 50 " "
Hire of the mill and pans	16 " "
Goolava wages	8
Jalive do	6 "
Bullocks (interest on cost of)	5 0
(The bullocks eat a large share of the cane tops)	
Cost of erecting the Goolal ghar or boiling shed	1 "
Cost of cloth for moulds, Lamp oil and sundries	2
Cost of preparing 1 acre of raw sugar ...	Rs. 83—8—0
Cost of growing the cane ...	Rs. 298—8—0
Total cost of 6096 lbs. ...	Rs. 382—0—0

PRICE OF GOOL.

The price of raw sugar (Gool) varies much between Rs 13 and 20 per pulla. At present (May 1886) it is selling at from Rs 6 to Rs 19 per pulla.

The Pulla is 240 lbs. but above this quantity 14 lbs is demanded as wadhawa; this is an allowance taken by the wholesale buyer as tret to cover loss by evaporation and other causes.

Therefore the cultivator may take the pulla of gool to be 254 lbs. and as annas 12 per pulla brokerage is demanded the cultivator gets Rs 16-4 per pulla for 24 pullas equal to Rs 390 for sugar plus 12 Rs for 1 ton of fodder equal to Rs 402 against an expenditure of Rs 382 per acre.

The labour in the above estimate is taken at the price labour can be hired and it will be observed that the balance on the credit side is very small. The work is carried on almost entirely by the peasantry by the aid of funds advanced on the prospective crop and to such people the sugar industry is a great boon. There is no margin for idlers but the cultivator by very careful management may reduce some of the figures slightly and if he is fortunate he will earn Rs 20 or Rs 30 per acre above the ordinary wages of a labourer. A very poor return for his responsibility while the money lender who takes R 1½ per month per cent. for his capital, holds the crop as security, and deducts 14lbs. in 254 for tret, annas 12 per 240 lbs. for brokerage, and buys at the rate of the day surely is doing good business.

YIELD PER ACRE.

In stating the yield of cane given per acre small experiments must be particularly avoided when dealing with sugar cane, because there is scarcely any plant to be found that yields produce in proportion to high culture and manuring to such a degree as cane does. Old cultivators here say there is scarcely any limit to the size that cane can be grown if abundant manure and water are provided but it is distinctly believed that no profit is to be made by growing the cane very large. When a moderate size is surpassed the cane becomes too heavy to bear its own weight, falls down and brings down other canes with it until the whole are greatly entangled, and inverted sugar, developed in the cane,

30 tons per acre of cane is a fair average for the district; sometimes much heavier crops are obtained. A few years ago when manure was cheap 45 tons per acre was not uncommon.

Ardhele system.

A system of payment for labour by a share of the produce called *ardhele* prevails to a considerable extent when the land is not dircetly in the possession of the cultivator. In this system the landholder gives the use of land, water, seed, and part of the manure and takes two-thirds of the produce, while the cultivator gives his own and his bullocks' labour and takes one-third of the produce. If the landholder gave the whole of the manure and the quantity was a liberal allowance so that the peasants' labour would not be thrown away, the agreement would be a fair one.

Preparation of Sugar near Poona.

About 40 years ago Dr. Gibson introduced at Hewra 40 miles north of Poona the manufacture of Sugar by the method at that time practised in the West Indian Islands and the manufacture was carried on by Mr. Dickenson about twenty years.

The method practised in the West Indian Islands in those days differed little from that followed near Poona at present, but the freshly boiled sugar after cooling was placed in hogsheads arranged to permit the uncrystallisable sugar in part to drain into tanks; the proportion of that form of sugar produced appears to have been much greater than what is produced in this district at present, probably from the amount of stirring and ladling from one pan to another the boiling sugar was subjected to.

A portion of the West Indian sugar was purified by the process called Claying and this process as introduced at Hewra was as follows.

The boiled sugar was transferred from the boiling pan to the cooler and when cool placed in conical shaped pots. The apex of the cone was pierced by a small hole and the pot stood in another arranged to keep it upright. After standing a day, or so, a layer of washed clay was placed on the sugar, and water poured on gently. The water passed down through the sugar carrying with it the uncrystallisable part and a small proportion of the crystalline sugar dissolved which was used in the distillation of rum.

The sugar produced was a fine granular product of a brown colour. Sometimes a solution of pure sugar was passed down through the dripping pots which coated the previously formed crystals increasing their size and improving the appearance of the sugar.

The manufacture was abandoned about 15 years ago as it could not compete with the Mauritius sugar.

A sugar factory on one of the modern system has recently been erected near Poona.

Cane growing in other countries.

The chief sugar cane growing countries in the world, Mauritius, West Indian Islands and and Louisiana, enjoy a moist tropical climate. Irrigation is seldom employed and the cane plantation once made lasts 7-10 years. In such circumstances the stirring of the soil is chiefly done by the hoe. The size of the canes produced and the quantity of sugar extracted is not a rule greater than near Poona. Trashing or removal of dead leaves from the cane is conducted with great care and this operation is believed to increase the quantity of sugar.

Sugar-boiling in other Countries.

Spon's Dictionary of the Industrial Arts gives an excellant account of this industry which should be refferred to by any one seeking full information. Here a faint out-line can be given. The juice on being expressed is carried to a large tank called the defecator, heated with steam pipes where it is heated sufficiently to separate the impurities. The purified juice is then carried to air tight pans usually arranged in threes, a slight vacuum is kept in the first pan, a higher in the second and a vacum almost complete is maintained in the third. This causes the syrup to crystallise in large crystals and to boil rapidly at a low temperature. After being boiled the sugar is passed to machine called centrifugals which consist essentially of a cylindrical basket revolving on a vertical shaft, its sides being of wire gauze or perforated metal for holding the sugar. The basket is surrounded by a casing at a distance of 4 inches, the annular space thus left being for the reception of the mollasses, which is expelled by centrifugal force through the sides of the basket when the latter revolves at high speed. An arrangement for introducing steam or hot dry air is often affixed to the centrifugal machine. The steam dissolves the molasses and causes it to fly out at the sides of the rapidly revolving contifugal machine and the hot air carries away the superfluous moisture. This is the system employed in advanced sugar making countries such as Mauritius.

Purification of raw sugar.] The Raw or impure sugars as Gool, Mascavado and other varieties produced by old fashioned systems of boiling are purified by dissolving with steam, then passing the dissolved sugar through a filter consisting of bones which have been calcined in a close retort so that all animal matter is burned away and the bone earth only left behind. This dissolved sugar is then recrystallised in a vacunm pans.

CULTIVATION OF TOBACCO IN LOWER BURMA AND JAVA.

The tobacco grown by the Burmese in Lower Burma is usually planted in alluvial deposits without any preparation of the soil. The seed is sown broadcast on the damp mud, and thus allowed to germinate, which usually takes about eight days. When the plants are well up, they are thinned out here and there where crowded and the surplus plants disposed of at the rate of Re. 1 per hundred plants. The remaining plants are left pretty much to themselves, very little (if any) hoeing or harrowing is done.

Mr. Cabaniss has instituted nurseries for transplanting at his own farm. A better crop could be secured if the same plan were resorted to by the Burmese themselves. The plants could then be planted out at regular intervals, each plant would have its own area of land to grow upon, and a more regular crop would be the result. Where village upland is used for tobacco cultivation, the soil is ploughed up three or four times, also partly broken up by wooden rollers and five pronged wooden harrows; in these lands the seed is also sown broadcast, the plants coming up very irregularly.

The soil is not pulverised as in Upper India, but broken up into small nodules or lumps.

Curing.]—Some of the tobacco cured by the Burmese themselves after their own method, does not differ materially from that of the people of Upper India, only less care is taken over it; the plants are cut when ripe and left to cure in the sun, exposed to rain and night dews.

Mr. Cabaniss has induced a few of the Burmese to try shade-curing, which would greatly improve the quality of the leaf, he also says that shade cured tobacco fetches Rs. 40 to Rs. 50 per 100 viss, about 350 lbs, which would be one anna and ten pies to two annas three pies per lb. Sun-cured tobacco fetches some ~~Rs~~. 10 less per 100 viss.

The seed is sown in December and January, and takes about eight days to germinate.

Curing sheds in Java.]—These sheds are built very large and roomy, made up of bamboos and palm leaf thatch with plenty of space, so as to permit free circulation of air and to prevent house-burning, while allowing the plants to hang free of each other.

These sheds are 300 feet long, 60 feet high in the middle, by 60 feet broad, and would contain 30,000 lbs of leaf hanging up.

In this part of the district the planter grows his tobacco on much the same plan as that pursued by the tobacco farm at Poosa, Tirhoot, namely, the cultivator receives so much advance on his land which he cultivates himself, receiving the seed from the planter.

The seed beds are 30 feet × 3 feet in size.

The exact proportions for sowing the seed are as follows:—

With 1 ounce of seed mix 4 ounces of ashes (wood) and one ounce of dry sand, then scatter over the beds and rake over.

When the plants are ripe, they are brought by the planter at rates of 9 to 10 guilders and sometimes when very fine plants as much as 20 guilders are given for 1,000 plants.

These rates vary according to the weight, size, and texture of the leaf.

Planting.—The seedlings are planted out at a distance of 2½×2½ feet apart from each other, they are topped when 8 to 10 feet high. The plants grow tall with long narrow leaves, and about 20 leaves are allowed to remain on each plant.

In the Kedirie districts the planters in most cases possess the land and then can make their own arrangements about growing their crops.

4 to 500 lbs is the average turn-out per bigha.

Curing]—When the plants are ripe they are cut close to the ground and then hung up in the sheds with twine or some fibrous roots. No splitting of the stalk is permitted as the object of the planters is to cure slowly.

The curing of leaves usually takes about 24 days if the weather is moist and favourable. The color turns out a light brown, which becomes a darker shade through fermentation. If the weather is hot and dry, the leaves cure quicker and become more or less yellow, which is a bad colour and unsuited for the manufacture of cigars.

Otherwise the curing process is the same as pursued in shade-curing in India.

Fermenting.—When ready cured, and when the leaves come in order, *i. e.*, become moist and limp, the tobacco should be taken down and bulked, the leaves having been first of all stripped from the stalk.

The leaves are bulked in three bulks of some 4,000 lbs. each, ends outwards.

Some planters fasten a thermometer on to a thin stick, which they insert into a hollow bamboo previously placed, so that the thermometer reaches and remains in the centre of the bulk.

When the temperature is to be tested the stick is drawn out, the hollow bamboo remaining fixed.

There can be no fixed rule as to the number of degrees you should allow the tobacco to ferment as some leaves are of finer texture than others, and should not be allowed to heat so much as leaves of a coarser kind. However, leaves of the finest sort should not be permitted to exceed 105°, and those of a coarser texture might rise up to 107° to 108°. The object of the thermometer is to let you know the degree of heat, so that the bulk may be opened in time to prevent the leaves from over-fermenting and rotting.

After the tobacco has been bulked a few days, it will have to be cooled. The bulk is then opened, and the hands of tobacco well shaken and cooled. After the cooling process is finished, two of the bulks are made up again into one, taking care, however, that the hands of tobacco forming the outward sides of the first bulks should now be placed more in the centre, and those previously inside now form the outsides.

In a few days the bulks will heat again, and must be opened and treated nearly the same way, except that the light colors should be placed in the centre, and the darker ones bulked all around them. Three bulks of as near as possible the same degree of temperature should now be made up into one large bulk of 10,000 lbs. or so. Some of the bulks contain as much as 40 to 50,000 lbs. of tobacco. Each bulk receives as it were three heatings.

The bulks are raised three feet off the ground on platforms; this is to keep off the damp as much as possible.

Several of the planters in Java dispense with the thermometer altogether and simply ascertain the heat by thrusting their hand into the bulk.

Sorting.]—The tobacco seldom heats after the third; time if it should, however, still continue to sweat, the bulks must be opened and treated as above explained. As soon as the fermenting is over, the bulks are opened and the leaves arranged for sorting. These leaves are sorted into:

Brown—clear, light, and dark.

Red—light and dark.

Black—light and dark.

Fahl—light and dark.

Streaky.

These are again divided into five different lengths for each color. Scrubs, which are very small, and poor leaves are sold locally.

The tobacco costs about 30 cents shipped (5 annas) per lb. and fetches about 50 cents (8 annas) per lb. in Amsterdam.

The tobacco after sorting is baled into square boxes lined with palm leaf matting, and when the tobacco is well pressed, the bale is made by sewing up the sides and tops.

A ratched screw with four handles is used for prising.

Cultivation.]—In Sumatra tobacco lands are used once in ten years, after having once had a tobacco crop, they are left alone untouched for nine years.

In Java owing to all the land being under some sort of cultivation, the planters grow on the three-year rotation system.

NEWS,

Wheat Crop in the Punjab

The accompanying statement gives the ascertained areas for every district, including those of the nine districts, the returns of which had not been received when the last report was sent, and an attempt has been made to give an estimate of the probable produce of each district. The correct area is 6,970,600 acres instead of 6,978,600 as shown in the last report. The difference is immaterial. The yield is calculated to be 2,039,384,600 seers or about 36½ million cwts. The average produce for the whole Province is 293 seers or about 5¼ cwts. Now the average outturn in Great Britain in 1885 was 31·31 bushels or (taking a bushel as containing 64 lbs.) nearly 18 cwts. per acre. The difference is very great. But a great deal of wheat is grown in this Province under circumstances in which it would not pay an English farmer to grow it. The Punjab farmer usually works his own land, his wants are few, and the Government revenue is light. It pays him to grow wheat on comparatively poor soil and he does it. The outturn per acre in the United States was said in 1884 (not a very good year) to have been 11·6 bushels or about 6¼ cwts, per acre. This is not a much higher average than in the Punjab. Five-sevenths of the total wheat acreage of the year was contained in the following 15 districts:—

Distrct.		Area in acres.	Average produce, in seers.
Umballa	...	271,000	261
Hushiarpur	...	219,200	233
Jullundur	...	287,700	400
Ferozepur	...	324,600	320
Multan	...	230,100	368
Lahore	...	364,600	315
Amritsar	...	324,700	414
Gurdaspur	...	319,000	2?9
Sialkot	...	398,700	314
Gujrat	...	306,800	315
Jhelum	...	454,600	121
Rawalpindi	...	530,000	220
Peshawar	...	313,300	258
Bannu	...	320,000	264
Dera Ismail Khan		262,300	361
		4,926,600	

An increased acreage of wheat is expected in Victoria. Splendid rains have fallen in all the Australian colonies. A copious rainfall has occurred over the whole of Southern Russia, where drought was causing much anxiety. A canal between the White Sea and the Baltic Sea has been determined upon by the Russian authorities. The cost, which is estimated at seven million roubles, will be borne by the State. Work, will, it is said, be begun upon the canal in the present year. In Egypt the wheat crop is reported to be a large one, but it comes very slowly forward. Lentils are short and the supplies of beans are falling off. In France the weather has been cold and stormy, and damage is apprehended to the wheats coming into blossom. In Germany crop reports continue to be very satisfactory. Continental markets have been somewhat weaker for all grain for consumption. "Term" markets have shown a slight improvement.

The establishment of fish-curing yards in the Madras Presidency seems to ~~have~~ given a great impetus to the salt fish trade. Last year 532,443 maunds of fish were cured, being an increase of about 32 per cent. over the previous year, while the quantity of salt used was 58,435 maunds.

The cinchona trade in the East has of late years made very rapid progress. Last year twenty million lbs. of bark were imported into England of which Ceylon contributed twelve million lbs., Java 1,300,000 lbs., and India 600,000 lbs.; the

balance coming from America. It is not likely that the large supply of bark from Ceylon will be kept up now that tea-planting is so much more in favour, and as the price of the bark in London, which for some years averaged upwards of ten pence a lb., has now fallen to four pence a lb., it makes the growth of cinchona an unprofitable speculation.

The quantity of tea exported from China and Japan to Great Britain from the commencement of the season to the 1st of July, was 55,251,712 lbs., as compared with 49,170,477 lbs. exported in the corresponding period of last year. The exports to the United States and Canada during the same period amounted to 16,577,882 lbs., as compared with 6,790,605 lbs. last year.

The actual receipts from four sales of Bengal opium and three month's pass duty in Bombay amount to Rs 2,63,81,010, which is Rs 56,010 better than the estimate. Bengal opium has realised Rs. 5,36965 below, and Bombay opium Rs.5,92,975 above estimate.

In the last quarter of 1886 the quantity of wheat received in Bombay was 1,702,737 maunds imported as compared with 2,972405 maunds imported in the corresponding quarter of 1885. The imports of oilseeds came to 1,572,840 maunds, as against 2,671,226 maunds.

The exports of tea from Calcutta to Great Britain in June amounted to 2,656,741 lbs., as compared with 3,096,974 lbs. in June, 1885, and 1,532,572, in June 1884.

The sale of the Indian art wares at the London Exhibition has far exceeded expectations. The red star denoting purchase is to be seen on a large proportion of the saleable art wares. The Moradabad brass ware and Burmese silver work seem to have been most in demand. An important movement has also been made in the direction of utilising the magnificent collection of the raw products of India gathered in the Imperial Court.

The American Exhibition in London.—President Cleveland has accepted the honorary presidency of the American Exhibition to be held in London in 1887, and will perform the opening ceremony by telegraph from the White House.

Messrs William Moran & Co's. Market Report, 17th July.—Heavy and in some cases excessive rain fell generally during the early part of the current month over all the various Indigo districts, and prospects on the whole are decidedly less favourable than they were a month back. From Lower Bengal the accounts are not good; from nearly all quarters we recieve complaints of blight, insects, loss of leaf, and consequent poor produce in the vats; this division is likely to fall far short of the expectations formed in the spring. From Behar the reports vary; the very heavy rain above alluded to swamped a good deal of plant, more especially in the neighbourhood of Durbungah. *Mahai* is now general everywhere; Champarun is getting good produce, while in Tirhoot and Chuprah it is but middling. Of late the weather has been fine and sunny, so we may expect to see better returns in the next reports. Benares and the North-West Provinces have had quite as much rain as was needed, and in many places too much. *Mahai* will not begin for another fortnight. Reuter gives the result of the London July sales as under:—

Offered 7,500 chests.		Sold 3,800 chests.
Good and Fine Bengals	...	3*d.* to 4*d.* per lb. lower.
Middling „	...	par
Ordinary „	...	2*d.* „ „ higher
Oudes generally	...	par
Kurpahs „	...	par
Madras Dry Leaf	...	par
Bombay Figs	...	3*d.* to 4*d.* „ lower

Messrs. J. Thomas & Co's Price Current 17th July:—During the last fortnight two auctions have been held, at which 15,252 packages have changed hands *viz.*, 7664 packages on the 8th and 7,588 packages on the 15th instant. On the former date the sale passed off without animation; Common Pekoes and Broken Pekoes were again easier, desirable invoices alone meeting with good competition. There was a good general demand, prices for common grades showing a hardening tendency and a few choice parcels selling at very full rates. Medium to good Broken Pekoes also met with more attention than hitherto. Heavy floods are reported from Cachar, otherwise the news from manufacturing districts is favourable.

	1886. lbs.	1885. lbs.	1884. lbs.
Deliveries in London June	5,400,000	3,600,000	4,600,000
Deliveries in London from 1st January to 30th June	34,900,000	37,400,000	31,500,000
Stock in London on 30th June	18,362,158	11,550,234	17,497,000

The cotton industry in the North-West Provinces is making steady progress. A company, we hear, is being started at Agra, with a capital of nine lakhs, which has been subscribed chiefly by the people. The motive power for the mill is being procured from Bombay. Another company, with a capital of six lakhs, has been formed at Delhi, for which most of the capital has also been subscribed locally.

Burma Petroleum.—As compared with the American oil the Burma oil is deficient in illuminating power. The American product yields about 65 per cent. of burning, or kerosine oil, while the Burma gives between 40 per 50 per cent. But this is, after all, in favour of the Burma oil,

By the light of his discovery of the lactic ferment, Pasteur soon found a new ferment—the butyric, which has its own special fermentation, resulting in the production of butyric acid. This organism consists of minute rods, separate, or united in chains of two, three, or more, which reproduce themselves by division, and which have the power of movement—gliding in an undulating manner, and breaking themselves off from each other by this motile faculty. They can be grown, like the other ferments, in fluids containing fermentable substances, in which they will multiply to an almost indefinite extent, their increase marking the progress of the butyric fermentation. In studying this organism or vibrio, Pasteur came upon a new and altogether startling peculiarity of these ferments—that they can not only multiply freely without air, but that the presence of air deprives them of life, and stops the fermentation to which they give rise. A stream of pure carbonic acid, so deadly to animals, may be passed through the fluid in which they are growing, without affecting them; but if a current of atmospheric air be substituted for the acid for a brief space, the organisms subside motionless to the bottom, and fermentation is at once arrested.

The question as to the way in which the ferments induced the phenomena of fermentation had to be answered, and in attempting it Pasteur was brought nearer to a solution of the mystery. The micro-organisms, like the higher animals, were nourished upon suitable pabulum—living upon a portion of the fermentable matter; but while the animal, for a given weight of nutritive matter ingested, assimilates a certain quantity, the "microbe" (as Sedillot named these minute plants), in consuming some of the matter, decomposes a quantity far in excess of its weight. The "must" or sweet wort of beer or wine, when placed in vats or barrels to produce these fluids, will undergo fermentation when yeast has been purposely added, or when the ferment-germs have been accidentally introduced; and the vital actions of the germs—multiplication, and increase in weight and volume—go on entirely independently of the free oxygen of the air, or of that in the "must." In the immense vats of breweries, fermentation disengages quantities of carbonic-acid gas, which is so much heavier than the atmosphere, that it rests in a dense layer on the surface of the fluid, and completely excludes the air. Yet the ferment-cells multiply with extraordinary rapidity, notwithstanding the entire absence of air or free oxygen; while their activity during this period is exhibited in the enormous difference between their weight, when collected as yeast at the termination of the process, and the weight of the "must" or sugar which has fermented, and been transformed into alcohol, carbonic acid, and some other products. It has been computed that a pound of the ferment will cause the transformation of one hundred and fifty pounds of sugar into alcohol.

In shallow vessels, Pasteur found that the ferment was even more active than in deep vats, though exposed to the air; but then much less sugar was decomposed—not more than five or six pounds. It was thus demonstrated that the more free oxygen the ferment consumes, the less does it act as a ferment; while the more completely its vital functions are carried on independently of air or free oxygen, the greater is its power of transforming or decomposing sugar. Life without air, and the process of fermentation, are correlative incidents; though it is to be observed that oxygen is essential to the life and growth of the ferment-cell, and when not obtainable from the air, it takes it from the saccharine matter, which contains it; in doing this it produces alcohol, which is merely sugar, *minus* some of its oxygen. This ferment-cell or vibrio, and others of its kind, can only live and multiply without air so long as it receives a sufficient quantity of suitable food; when this is consumed, it dies, and further transformation of the matter ceases, unless another kind of organism finds access.

These investigations led Pasteur to recognise two classes of microscopic organisms—one which requires air or free oxygen in order to exist and multiply, and which he named *ærobies*; and another which could live actively in the absence of free oxygen, possessing itself of this essential element by taking it from its combinations in the food supplied to it—this class he designated *anærobics*, and its discovery caused much astonishment. Dumas, the celebrated chemist, said one day at the Academy of Sciences, in addressing Pasteur in reference to the last-named class: "In these infinitely small organisms you have discovered a third kingdom—the kingdom to which these organisms belong, which, with all the attributes of animal life, do not require air for their existence, and which find the heat that is necessary for them in the chemical decompositions they set up around them."

The potency of the anærobic class to act as ferments, it may be observed, depends upon their capacity to live without air, by breaking down pre-existing compounds, and forming new and simpler ones; this done, they perish, and then the ærobic germs may, in their turn, live upon them, and convert their remains into other compounds.

Carefully conducted experiments demonstrated that fluid organic matters deprived of all microscopic

germs, retained free oxygen for any length of time, and remained unchanged; but if living germs were allowed access to such matters when kept in closed vessels, in a few days there was no oxygen, but carbonic acid. So it was proved that, contrary to the notion previously entertained, oxygen has but little influence in promoting decomposition when germs are absent; though when they are present it acts most powerfully.

Putrefaction is simply fermentation, the sole agent in one as in the other being microscopic organisms, the fermentation of sugar being simply the putrefaction of sugar. It had long been known that fungi, or microscopic animalculæ, were present in putrefying organic compounds; but that they were the real agents in effecting putrefaction was not proved, and by such authorities as Liebig was even denied. Here, again, Pasteur showed that the destruction of animal and vegetable matter was a process of slow combustion, brought about by appropriation of oxygen, from the air through the instrumentality of ærobies which, in reality, have the faculty of consuming the oxygen and are the powerful agents in restoring to the atmosphere and the soil the elements of things which have lived. Mildew, mould, and other cell-formations, two thousand of which would not measure a millimetre, carry on the great work of maintaining the equilibrium between life and death—they themselves dying and being preyed upon by others; so that the ferments are fermented by other ferments.

CALCUTTA MARKET REPORT.

For the week ending 9th July.

Tea—The usual weekly auctions were held on the 8th instant, when 8,000 packages were brought forward, of which 7,620 changed hands. A few invoices of desirable quality met with a good enquiry and were sold at steady rates, whilst some half dozen lines with special character were keenly competed for at high prices. With these exceptions there was a dull market, and rates for poor to common liquoring Pekoes and Broken Pekoes were 1/2d. and 1d. lower. In Souchong kinds there was also a slight decline.

At the London auctions this week 8,000 packages were offered and 6,700 sold. The sales were rather weaker, but there was generally no meterial change in prices.

Wheat.—There has been a good demand, especially for immediate delivery and about 4,500 tons have been disposed of. The sales comprise Cawnpore at Rs. 2-8-9 at Rs. 2-9. Sibgunge at Rs. 2-8-6. Jamally at Rs. 2-5, and Gungajelly at Rs. 2-7-6 to Rs. 2-8-6.

Linseed.—About 2,500 tons have been sold during the week at previous prices say Rs 4-7-3 for small grain 5 per cent. refraction.

Poppyseed.—About 500 tons have changed hands during the week at Rs. 3-12-6 to Rs. 3-12-9.

Rapeseed has been neglected.

Jute.—Business in baled jute has been done to a moderate extent in the better and in ordinary marks. In some instances balers have seen their way to reduce their prices, but as a rule they have been very firm.

For the week ending 16th July, 1886.

Tea. The usual weekly sales were held on the 15th instant, when 7,800 packes were offered and 7,600 sold. There was a more general enquiry, and prices of all kinds were firm at last week's rates, whilst fine teas were rather higher. At the London auctions this week 9,000 packages were put up for sale, and 8,300 changed hands. There was no material alteration in prices, and the sales went off without animation.

Wheat.—About 6,000 tons have been disposed of at slightly advancing prices. Quotations are Rs. 2-11 for Buxar, Rs. 2-9 and Rs. 2-5 Cawnpur, and Rs. 2-7 to Rs. 2-7 for Sibi.

Linseed.—The sales reported during the week amount to about 3,500 tons. Small grain Linseed 5 per cent. refraction is quoted to-day at Rs. 4-7 and the market closes with a rather easier tendency.

Poppyseed has been in less demand, and has declined from Rs. 3-13 to Rs. 3-12.

Jute.—Balers have shown more disposition to meet the market, and sales to a moderate extent have been going on daily. The prospects of the new crop continue to be very favourable.

For the week ending 23rd July, 1886.

Tea.—Public sales were held on the 22nd instant, at which 8,000 packages were offered and 7,450 disposed of. The catalogues contained some desirable liquoring invoices of Assam tea, which were well competed for at comparatively high prices, but the greater part of the sales was composed of teas with pointless liquor, and these were neglected, and sold at lower rates.

At the London auctions this week 14,000 packages of Indian Tea were offered, of which 11,400 changed hands. The sales were irregular and prices rather lower.

Wheat.—There has been a fair demand for this staple, which has resulted in the sale of about 6,000 tons at Rs. 2-9 @ Rs. 2-9-6 for Cawnpore, and Rs. 2-8-6 @ Rs. 2-9 for Sibguuge.

Linseed.—About 3,500 tons are reported to have changed hands during the week at Rs. 4-7 for small grain 5 per cent. refraction, and Rs. 4-4-6 @ Rs. 4-5 for 10 per cent. refraction.

Poppyseed.—The transactions of the week are estimated at about 1,000 tons at Rs. 3-12-5 to Rs. 3-12-9.

Jute.—There is no change to be noticed in the market for baled jute. A small business has been in progress, but balers generally prefer waiting to accepting the prices which are offered at present.

CROP AND WEATHER REPORTS.

For the week ending 30th June, 1886.

General Remarks.—During the week under report rain has fallen in nearly all parts of India, except the Western Punjab, and the falls have for the most part been abundant.

In Madras, Mysore, and Coorg prospects cotinue favourable.

Sowings for the kharif are in progress in Bombay, the Punjab, the North-Western Provinces and Oudh, Rajputana, the Central Provinces, Berar, and Hyderabad.

Agricultural prospects are very good throughout Bengal, the standing crops are doing well, transplanting of aman rice has commenced, and bhadoi sowings are in active progress in Behar. In Assam ploughings continue, and prospects are favourable.

The public health continues generally good.

Prices are generally steady, except in the North-Western Provinces and Oudh and in the Delhi district of the Punjab, where they are fluttuating, and in the Rawalpindi district of the Punjab and in Coorg, where a rise has taken place.

For the week ending 7th July, 1886.

General Remarks.—In Sind and some districts of the Western Punjab little or no rain has yet fallen, but elsewhere rain has been general, and, except in parts of Southern India and Rajputana, on the whole abundant.

The season continues to promise well in Madras, Mysore, and Coorg.

In Bombay, the North-Western Provinces and Oudh, the Punjab, the Central Provinces, Berar, Hyderabad, and Rajputana kharif operations continue. Agricultural prospects in these Provinces are generally good.

Prospects continue very satisfactory in Bengal, and are for the most part good in Assam.

The public health is fair in all Provinces.

Prices are rising in the Hissar, Delhi, and Shahpur districts of the Punjab, in Kolar in Mysore, and in Coorg, and are fluctuating in the Mooltan district of the Punjab. Elsewhere they are generally stationary.

For the week ending 14th July, 1886.

General Remarks.—Except in the Mooltan and Dera Ismail Khan districts of the Punjab and in Sind, rain has been general, and in most places abundant, during the week under notice.

The season continues favourable in Madras, Mysore, and Coorg, and the standing crops are in fair condition.

In parts of Bombay more rain would be beneficial. Kharif sowings are in active progress in that Presidency and in the North-Western Provinces and Oudh, the Central Provinces, Berar, and Rajputana. Where sowings have been completed, the young plants generally promise well. More rain is wanted in the western districts of the Punjab.

Prospects continue very favourable in Bengal, though some injury has been caused by floods in Behar. In Assam floods have also done harm in the Surma Valley districts, but in other respects the season promises well.

In British Burma ploughing, sowing, and transplanting of rice are in progress.

The public health remains generally good in all Provinces.

Prices are stationary, except in the Mooltan and Dera Ismail Khan districts of the Punjab, where they are rising, and in the Delhi district, where they are fluctuating.

For the week ending 21st July, 1886.

General Remarks.—Rain is reported from all parts of the country during the week under notice. In the North-Western Provinces and Oudh and in most parts of Bengal the falls have been light.

Agricultural prospects continue fair in Madras and good in Mysore and Coorg.

In Guzerat the kharif sowings have been retarded by excessive rain, while more rain is wanted in some of the central districts of the Bombay Presidency. In the North-Western Provinces and Oudh and the Central Provinces sowings are almost completed, and in Hyderabad and Rajputana they are progressing satisfactorily. More rain is wanted in the Peshawar district of the Punjab; elsewhere prospects are generally favourable.

In Bengal generally the partial break in the rains has been beneficial, but in places in Western Bengal and Chota Nagpur more rain is wanted for transplanting late rice. Early rice jute, and sugarcane are doing well, and the harvesting of the first two crops has commenced. Agricultural prospects continue satisfactory in the Assam Valley districts, but considerable injury has been caused by floods in Sylhet.

In the British Burma ploughing, sowing, and transplanting operations are in progress.

The public health continues generally good.

Prices are rising in the Hissar and Ferozepore districts of the Punjab, and are fluctuating in the Delhi district and in the Bangalore, Shimoga and Kadur districts of Mysore. Elsewhere they are stationary.

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Nagpur Experimental Farm.—So far as the Kharif crops during the year ending March 31st 1886, were concerned the season was a favourable one, especially in the case of the cotton and til crops which yielded a larger outturn than has been obtained during late years. The prospects of the rabi crops were somewhat damaged by the failure of rain in September, but this was to a great extent compensated for by a fall in October, and the crops in the early part of the season promised well. But the continuance of cloudy weather during December and January induced an attack of rust of exceptional severity, which very greatly reduced the out-turn of the wheat and totally the destroyed a large portion of the linseed. That decrease in out-turn has resulted from the seasons and not from any loss in fertility on the part of the Farm land, is established by the fact that the out-turns follow tolerably closely the "anna" out-turn estimates which have been framed each year for the Nagpur district. The rust attacked with most severity the crops which were on the richest soils and hence the results which have been obtained in comparative experiments with manures are nearly valueless. The out-turn of straw was but little affected by the rust and hence there is the anomalous result that in the season under report the weight of straw is a better indication, than the weight of grain, of the effects of each manure.

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The most practical of all the manure experiments is that conducted by ploughing hemp in green—a process which has yielded excellent results on the Cawnpore Farm. But this experiment suffered this year a special disadvantage. Owing to the failure of the September rain, the hemp did not decompose as it should before the sowing season, whilst the deep ploughing which was necessary in order to turn it into the soil occasioned a loss of moisture which could not be spared. The results of the past season throw but little light on the real utility of this process. The Upland Georgian variety of cotton has now proved its value. The out-turn was not very large in quantity as the crop was grown on comparatively poor land but it was quite as large as would have been gathered from cotton of the ordinary bani kind of this land. The quality of the produce was very favourably reported on by the Manager of the Hinganghat Mills. An endeavour is being made to induce a large number of cultivators in the Wardha district to grow this cotton during the coming season.

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An experiment of some practical importance is that which is being tried to determine the utility of embanking land as opposed to open field cultivation. Black soil is extensively embanked in the neighbouring district of Balaghat, and over a tract of country stretching northward from Balaghat which includes a large portion of the Seoni, Mandla, Jabalpur, Damoh and Saugor districts. The field banks in these districts represent a very large outlay of capital. In the black soil of Nagpur, Wardha and the Narbada Valley, the open field cultivation is the rule, and it would be interesting to discover by experiment whether this is the result of circumstances which render field embanking less profitable than in the

eastern districts. The experiments of the past season go to show that embankments would yield a fair profit on the Farm land. But the experiments were only initiated during the year under report and their results must be checked by those of two or three seasons.

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An ensilage experiment with Guinea grass succeeded very well and the experience of the year under report bears out that of previous years in showing that green fodder may be successfully stored in pits against the hot weather. I may mention here that duringthe year under report grass was very successfully ensilaged by the Superintendent of the Maharaj Bagh in the same manner as that adopted on the Farm. The trial was an interesting one as the grass was cut while in flower, before the end of the monsoon, when it was at its prime for cattle feeding purposes, instead of waiting till the rains were over. The quantity stored was 70 maunds and the expenditure was as follows:—Digging pit Rs. 1-3-2, cutting filling and ramming Rs. 3-14-10, total Rs. 5-2-0. About one-fifth of the grass was spoilt by mildew and, making a deduction on this account, the cost per maund (of 80 lbs.) was Rs. 0-1-6. The cost of cutting grass when dry, at the close of the rains, and stacking it is about Rs. 0-1-4 per maund. Deducting for the weight of the excess moisture in silage, its cost compared with that of dry grass is about Rs. 0-3-0 per maund. Very careful experiments would be required to show precisely the fodder value of silage as compared with dry grass. But it seems hardly possible that to obtain green fodder in the hot weather would not be worth an extra outlay of Rs. 0-1-8 per maund.

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EXPERIMENTAL FARM AT ALON, BRITISH BURMA.—The crops experimented with during 1885 were sugarcane and rice. Small quantities of indigo and of castor-oil seed were planted, but there was not space enough for a satisfactory trial. There were ten plots planted with rice. The seed was sown broadcast in the manner usual in the Pegu district. The large plot, manured with dissolved bones in 1883 and with conservancy manure in 1884, was divided into four; one was left unmanured, the others were treated one with lime, the third with nitrate of potassium, and the fourth with dissolved bones and nitrate of potassium. The plot manured with bone-dust in 1884 was again divided and one part manured with lime, the remainder were left as last year with the object of finding the enduring effect of the bone-dust manure. The lime was put on the land after the beginning of the rains; the first effect was to kill the weeds and then the rice was sown on it. When replanted, the crop did not appear to thrive and turned out smaller than the unmanured. The whole crop was about 15 per cent. better than last year when it was below the average from drought in September. Plants springing up from seed that had lain in the ground about the threshing-floor since last year were much stronger and produced better filled out grain than those sown at the ordinary time. The system of sowing immediately after reaping the previous crops is followed in some parts of the Madras Presidency. The seed is supposed to preserve its vitality better lying in the earth through the dry weathor. The difficulty here would be the ploughing up of the dry soil, which is impossible with the common Burmese implement.

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From a comparison of the yield of straw and grains, it appears that the effect of the manure put on the soil three years ago is not yet exhausted. The bad effect of the lime was no doubt owing to its being too fresh Thayetmyo lime, which is generally carbonated before it reaches Rangoon, did not seem to injure vegetation; it was where Moulmein lime had been put down that the plants were killed. The seed was sown broadcast as is usual in the Pegu district, not dibbled in as in former years. The most economical manure seems to be ground bones 5 cwt. of which, value Rs. 10, has produced a total increase of 2,175 lbs., or 43·5 bushels, in three years. Of course it will be impossible to say what the real value is until the manure is entirely spent. It seems that the time of planting has a great deal to do with the success of the crop. Some small patches were planted about three weeks before the rest and these were obviously better developed.

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Indigo.—Some indigo seed was obtained from the Government experimental station at Khanpur; part was sown at the time of the first showers in April, the rest at the end of May. The manures used were nitre and chloride of potassium applied to alternate beds. The indigo sown in April came up well, that planted later only grew a few inches and never flowered. The chloride of potassium produced no effect, the nitre made the plants more vigorous and the leaves turned dark green. The indigo was ready for cutting before the season of planting rice, hence it might be grown on the same soil The residue from the extraction of indigo is a very stimulating manure and might be applied to the following crop of rice. The drawback is that it would depend on rain falling in April, at least where there is no artificial irrigation; but it is the only

crop that can be grown with rice, and I think it would be worth while trying it at some of the Government farms.

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Sugar.—There were six plots of sugarcane planted with cane-tops bought in the bazar, supposed to be chiefly Bassein cane. The crop produced was a thick, brittle cane with joints about four inches long. Some plots were inteded for Moulmein cane, but there was none in the market. The manure used were—o-Unmanured, 1 Bone dust and nitrate of potassium, 2 Not planted (bone-dust). 3 Dissolved bones and chloride of potassium, 4 Chloride of potassium, 5 Nitrate of potassium after lime, 6 Dissolved bones and nitrate of potassium, 7 Not planted, 8 Not planted. The former experiments seemed to show that bone-dust is too insoluble for sugarcane. The experiment was repeated this year. The chloride of potassium is the residue from the manufacture of nitre. It contains 60·62 per cent. of chloride of potassium and 39 per cent. of chloride and sulphate of sodium. As it is only quarter the price of nitre, it would be a great advantage if it could be substituted for nitre in manures. The canes were planted in the furrows between the ridges raised about the roots of the former crop. The leaves were strippnd off and buried to enrich the soil with the salts they contain. Specimens were taken from each plot every week, pressed, and the juice tested with the polariscope. The results show little difference in sweetness between the different specimens. The effect of the manures was seen in the weight of the crop and the development of the canes. The heaviest crop was that grown on a plot top-dressed in January 1884 with lime. It lay fallow a season and then, in 1885 a top-dressing of nitre was applied to the crop. The next was the plot manured with dissolved bones and nitre, chloride of potassium alone came third, ground bones and nitre fourth, dissolved bones and chloride of potassium fifth, unmanured sixth. The results seem to show that chloride of potassium is inferior to nitre especially in producing a number of canes. The mixture of dissolved bones with chloride of potassium gave a bad result, probably because the excess of sulphuric acid in the dissolved bones evolved hydrochloric acid from the chloride of potassium; but the comparison of the second and the fifth plots show that there is some other factor in the problem, probably some difference in the soil.

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The greatest weight of sugar was produced by nitre after lime, the next by nitre and dissolved bones, about one ton per acre; the unmanured, half a ton. An important point is the proportion of non-saccharine substances in the juice since they prevent the crystallization of an equal weight of cane sugar. There is an average of about 15 per cent. of the total solids of this nature. It is supposed that the juice of the Bassein cane will not crystallise. By clarifying the juice with basic acetate of lead, filtering and evaporating, there was difficulty in crystallizing the solution. The crystallizable sugar is at the maximum in the month of October and the uncrystallizable at the minimum. There is no appreciable difference in the amount of sugar in the juice of the canes grown on different plots. The effect of the manure was shown in the size and weight of the canes and the number per acre The canes were hard and brittle; the joints about four inches long. There were two varieties supposed to be planted, but apparently they reverted to the ordinary type of cane grown in the district. The yield of sugar from the unmanured was about 10 cwt. per acre; from the best of the manured about one ton. The produce of sugar in Tahiti is six tons per acre; of beetroot sugar in France from two to three tons; in the West Indies from 15 cwt. to one-and-a-half tons. The Tahiti cane has been introduced into India, but I doubt if it will thrive as well as on the rich volcanic soil Tahiti and Fiji. The soil about Rangoon is not suited for sugarcne. The best I have seen in Burma is at Mergui, where the canes grow double the size they do here.

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Madras Carpets.—The following is an article by Mr. E. B. Havell, Superintendent, School of Arts, Madras. Information regarding the character and 'locale' of the carpet manufactures of Madras has always been somewhat imperfectly given. Sir George Birdwood, the best authority on the subject, describes (Indian Arts, Vol. II) four varieties—woollen carpets of Masulipatam and of the Malabar coast, Cocanada or Madras rugs, and silk carpets of Tanjore and Salem. As a matter of fact there is no evidence that there ever have been more than the present seats of the industry—Ayyampet, a village near Tanjore, Masulipatam and Ellore. There are also two looms at work at Wallajanuggur, North Arcot district, but the outturn is as poor in quality as in quantity. The carpets of Masulipatam and Ellore are identical in character so that practically there are only two varieties. The pattern given by the above mentioned authority as an illustration of the design of a Coromandel carpet (Hand-book to the Indian section of the York Exhibition) is of a good old Ellore type, which is still made at that place. "Cocanada or Madras rugs" are also identical with the smaller carpets of Ellore. No silk or any other description of carpets are now made at Salem.

The mats or small carpets of Ayyampet are seldom seen in the European market and the industry is fast falling into complete neglect. The designs are very striking, mostly of a bold and purely Hindu type, and the scheme of color, in harmony with the vigorous design, would seem somewhat alarming to the large section of the public which holds a strong "toning" with mother-earth to be a necessary element in artistic coloring. In the hand-book already referred to, there are illustrations of two typical specimens. One of the two Exhibition samples (Nos. 1908 & 1909) is characteristic, and a fairly good one. The other is more Persian in character. There are only 12 looms now at work and it is always difficult to get specimens of the weavers' best productions. The silk carpets of the same place are only procurable when specially ordered. The large carpets of Ellore and Masulipatam are also bold in design and coloring and somewhat Hindu in type, though many of the patterns are of purely northern origin. The most characteristic designs are always on the white ground, large in scale but never vulgar. It is difficult to obtain an adequate idea of the effect of their vigorous design from the samples sent from Ellore for the Exhibition. These were too small to show off the patterns to advantage and were not executed in the weavers' best style. Besides this the most typical patterns are not amongst them. The illustration of "the Malabar carpet," before aluded to, gives a much fairer impression of the best carpets made. Another class of pattern has a simple border of floral design running round the edge, but the centre is of one color, entirely plain.

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There are now about 50 Kharkhanas or houses of looms at Ellore employing over a hundred weavers. There are 18 houses at Masulipatam. The weavers here originally came form Ellore and their work is of the same character, but nearly all the best and largest carpets are made at the old seat of the industry. Madras carpets have lately fallen into disrepute, though probably as good carpets as ever have been made could be turned out if a healthy demand gave some encouragement to the weavers. Very possibly the carpets which were, until lately, largely manufactured in the jails, and which are still made to some extent, have passed for genuine native productions. It is but fair to state that in Madras jail carpets, the colors are from the same pure vegetable dyes used by the caste weavers. But it is absurd to suppose that the system of convict labor can produce a result as satisfactory as that accomplished by the skill and taste, partly hereditary and partly acquired by practice from the earliest childhood of the native caste weaver, who is not forced, in durance vile, to execute under fear of pains and penalties his allotted daily task. What this system can do at its worst was strikingly shown at the last Calcutta Exhibition. The jail carpets exhibited in the Hyderabad Court probably transcended any thing which has been before attempted in the direction of outrageous coloring and corrupt design.

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The carpets made in Madras jails are, however, generally at the respectable level of mediocrity. The designs are oriental in character, but they are rather heterogeneous, including some borrowed from inferior modern Persian silk carpets, many Cashmere and Punjab designs generally unsuited to the quality of wool in use, some good Madras patterns and others very debased. Another reason for the falling off in the demand for Ellore and Masulipatam carpets may be that the ordinary productions of the weavers, intended for the country bazaars, are often badly made and of inferior material and sometimes with hideous European designs. These are only made when the special order given are insufficient to keep the weavers fully employed. It is a mistake, as far as carpet weaving is concerned, to attribute the artistic or commercial decline to direct European influence. All the best carpets when I visited the Ellore looms were being made for European firms, and if it had not been for their support, probably the whole industry would now be engaged in the small rugs, inferior in design and execution, which are sold in the Madras and other bazars. The Ayyampet mats seem to have been never popular in the European market, and the decline must be attributed to an increasing preference among natives for cheap and inferior European manufactures. Carpets can still be obtained from Ayyampet, when specially ordered, in no degree inferior to work done twenty or thirty years ago.

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Bombay Agricultural Department.—A short description of the working of the Agricultural Departments during the year 1884-85, of the North-Western and the Central Provinces, Assam and Bombay appeared in the April number of I. A. Gazette, but that of Madras had to be omitted, because the report came to our hands very late. Under the head of analysis of district it is to be noted that Mr. Benson who is in charge of this work has compiled an analysis of only one district, namely, Kurnool but if it is desirable to go tthrough this important work satisfactorily and with reasonable expedition, it is indespensable that the staff of qualified

officers will have to be largely increased. Under the system of collection of revenue in precarious tracts, the Government has recognized the principle that the demand for land revenue should be made only after the ryot has harvested his crop. As this date varies in different localities they have proposed a scale of instalments which could be applied to all parts of the Presidency Government has further directed that except in the case of Zemindars and whole inam villages, interest on arrears should, not excepting in special cases, be charged until the end of the revenue year. Owing to the losses sustained by the agricultural population through the floods arising from the extraordinary heavy rains which fell at the close of 1884, the collection of the instalments of land revenue and the issue of coercive processes for the recovery of the same were, under the orders of Government, suspended at the discretion of the Collectors concerned.

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Measures of Protection.—With a view to encourage the construction of wells and thereby to tide over the effects of a failure of the ordinary rains, the Government have in the rules which they have recommended to be made under the Land Improvement Loans' Act, proposed the grant on liberal terms of advances, not more than Rs. 750, for the construction of wells for irrigation, these loans to be repaid within stipulated periods, not exceeding 35 years, by a special annual charge in addition to the land assessment. The rate of interest has been reduced from 6¼ per cent. to 5 per cent. while the period of repayment has been extended to a maximum of 35 years. Rules, under the Agriculturists' Loan's Act, have also been proposed by the Local Government for the sanction of the Government of India. These provided for the grant of loans, on liberal terms, to agriculturists for the purchase of seed-grain and ploughing stock, the construction of wells for domestic purposes and for the reconstruction of houses destroyed by flood or fire. Loans granted under these rules are not to exceed Rs. 1,000 and are to be repaid within a maximum period of 3 years. Provision has also been made for the grant, during periods of distress, of loans not exceeding Rs. 200, without interest, to ryots of small means, to enable them to subsist until the next harvest. The Famine Commission remarked that much of the poverty of the people of India and of the distress to which they are exposed, in season of drought, was due to the circumstance that agriculture forms almost their sole occupation. They therfore recommended that the State should encourage the introduction of a diversity of occupation, whereby the surplus population could be drawn from agriculture and induced to find a livelihood by manufactures and similar pursuits. In view to opening up the resources of the country other than agriculture, and to collecting and publishing more accurate information than is now available as regards mineralogical matters, the Government, during the year under notice, appointed a Mineralogist who took charge of his office in April last and who has, hitherto, been chiefly engaged in making a partial examination of a portion of the Nilgiri Hills. It is proposed that he shall hereafter take up and examine the district of Cuddapah, in which it is believed that considerable mineral wealth exists. As regards native arts and manufactures, Mr. Havell, the Superintendent of School of Arts, made a tour in several districts and examined what was to be seen in this direction. The result has been that many of the industries connected with native art have been found to be in a falling condition and, that others have, it has been ascertained, almost died out. Mr. Havell will make another tour during the ensuing cold weather and proposals with regard to this are being prepared.

* * *

Agricultural Experiments including farms.—Our readers may remember that the Saidapet Government Experimental farm has been abolished and no new farms will be established, but experiments if necessary will be made through the agency of private individuals who will be secured against loss. Meanwhile, Mr. Benson will carefully study the indigenous system of agriculture and will proceed with the agricultural analyses of districts. This course, it is hoped, will best enable the Government to ascertain the wants of the existing systems of native farming and to form something like a correct idea of the remedies to be emplyed and the improvements which may be possible. Of the private farms, there were three in existence during 1883-84, namely, at Chittoor, Madura, and Karur. Of these the one at Chittoor has collapsed. It was decided in 1883 that a quinquennial Agricultural Exhibition should be held in Madras and annual exhibition in Erode and Madura, alternately, for the Southern and at Gooty for the Northern Districts of the Presidency. An exhibition accordingly took place at Madras in February of that year but none could subsequently be held elsewhere, owing to the unfavorable character of the season both in 1884 and at the beginning of this calender year. Local Agricultural exhibitions have, however, been held at Madura and Rajahmundry under the auspices of the agricultual associations at those stations. The Government

contributed a grant-in-aid of a moiety of the expenditure. The exhibition at Rajahmundry was fairly successful. Samples of fibres prepared with the aid of Death and Elwood's machine from the manilla hemp (*Musa textilis*) and the ordinary plantain (*Musa sapientum*), grown in the Wynaad, were sent to England by certain private gentlemen. The valuation was very low, and it is evident that, unless very considerable improvement takes place in the process of preparation, the production of fibre from these plants is not likely to prove remunerative. It was hoped that Messrs. Harvey and Co. of Papanasam, in the Tinnevelly District, would be able to test the wild plantain (*Musa sapientum*) as a substance for the manufacture of paper. They have, however, recently intimated that they have given up the idea as it is difficult to procure a sufficient supply of the raw material. The experiment of cultivating Aloes (Agave Americana) in the Tanjore District, proved a complete failure. This seems to have been owing to the officer entrusted with the experiment having put the plants down in the same way as one would celery, instead of growing it on a raised bank. Nothing was done with regard to the "*Fourcroria Gigantea*," which is far superior to the ordinary aloe and which deserves attention.

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Veterinary Establishment.—From the report of the Inspector, Mr. Mills, it is to be seen that useful work has been continued. The department is yet in its infancy, and there are manifold difficulties to contend with. These, it is hopped, will gradually be met and matters be put on a footing, which will increase the utility of an undoubtedly desirable department. The Veterinary Hospital at Saidapet continued to be of great use to the probationers under instruction by the Inspector and also to the students of the School of Agriculture. One hundred and seventy-five cases were admitted against 160 in the previous year; of those 126 or 72 per cent. were discharged as "cured" and 11 as "incurable." Only 16 of the animals died. Mr. Mills mentions that a larger quantity of medicines was sent out to districts, during the year under report, than in that preceding it, but he has not given the figures. The question of moving the hospital to another site, or of extending and improving existing buildings, is under the consideration of Government. Mr. Mills made further experiments in protective inoculation according to M. Pasteur's method. The results have, as he states, confirmed his opinion regarding the efficacy of inoculation, but he thinks that the present arrangements for obtaining the anthracine are expensive and uncertain, and that they must preclude its general adoption, until the protective fluid can be manufactured in India. The people, moreover, are unwilling to allow their animals to be inoculated, but this is, perhaps, not a matter for much surprise, for even authorities on the Veterinary art are not quite unanimous as to the efficacy of the operation in preventing anthrax. Mr. Mills also conducted some experiments in trench cremation. He is of opinion, however, that, although burning is the only safe mode of disposing of the carcases of animals dying of anthrax and reinderpest, the dearth of fuel and consequent expense preclude the adoption in the Madras Presidency of the system. Mr. Mills found by experiment, that common salt is an efficient remedy for rot (fluke disease.) The statistics of cattle-diseases for the Presidency show that epizootic aphtha, anthrax and reinderpest were the most prevalent diseases during the year. The deaths from all diseases were 43,788, of which 11,226 were due to anthrax, 12,057 to reinderpest and 3,672 to epizootic aphtha. The returns, show that ·44 per cent. of the cattle suffered from disease, that ·24 per cent. died, and that the proportion of deaths to attacks was 55·45. There cannot be any doubt that the whole of the cattle statistics of the Presidency do not, even to a moderate degree, approach correctness. The subject has of late had closer attention than heretofore, and every effort to obtain improvement is being made. The remarks offered by Mr. Mills on the subject of cattle poisoning in the Bellary District, merit notice. It has long been known that this kind of thing goes on, or did so, recently, to a large extent in other parts of this Presidency. It is very often difficult to hunt down the culprits, and the owners themselves are often unwilling to prosecute. Stirring matters up through the agency of this department will no doubt be productive of good. Steps to do this will be taken. Local Cattle disease Inspector, K. Padmanabiah deserves considerable credit for the manner in which he has taken up and brought forward the subject of cattle-poisoning in the district in which he is employed.

* * *

Agricultural Statistics.—Arrangements are already in existence in the United Provinces, the Central Provinces, the Punjab, Assam and Bombay for issuing forecasts of principal crops and their condition and outturn. Even the incipient agricultural department of Bengal has issued for the first time a tentative forecast of the Jute crop in Bengal. Accordingly the Madras Government has also decided that in the course of each year, four forecasts and condition and outturn

reports regarding the principal crops of the province, namely, Paddy, Cholum, Cumbu, and Ragi of the food grains and cotton, indigo, sugarcane, castor oil and Lamp oil seeds, gingelly oil seeds and tobacco of the industrial crops.

* * *

Trade statistics.—The total foreign or external trade of the Presidency, including exports to and imports from, other Indian provinces and transactions in treasure and Government stores, amounted to Rs. 20,65,20761, of which Rs. 18 83 84 represented the value of the export trade, and Rs. 8,81,38,480 the value of the import trade. The chief articles of export were hides and skins, cotton (raw), coffee, indigo, seeds, grain and pulse, spices, sugar, oils, cotton piece goods, cocoanut kernel, coconnuts, coir yarn and rope, tobacco timber and wood. The chief articles of import were cotton piece goods, twist and yarn, grain and pulses, metals, apparel, liquors, timber and wood and railway materials. The interportal trade of the Presidency amounted to Rs. 4,16,22.469. The value of the total land trade was Rs. 6,95.08,524 of which Rs. 3,67,57,508 represented the value of the export trade and Rs. 3,27,51,016 that of the import trade. The chief articles of export were Indian and European piece-goods, rice and paddy, seeds, liquors, metals and spices. That chief articles of import were spices, seeds, coffee, living animals, grain and pulses, sugar, hides and skins, provisions and raw cotton.

* * *

MESSRS. LLOYD AND CARTER'S TEA MARKET REPORT OF 29TH JULY.—*Indian Tea.*—The first arrivals of the new season's Calcutta-bought teas have been placed on the market during the fortnight, and have met with a disappointing reception. The market has been very depressed. Prices have shown a gradual decline, notwithstanding the low quotations. Common Pekoes are down to the level of Pekoe Souchongs, and Broken Pekoes are nearly unsaleable, unless with distinct character. Good old season's are firmer. Quality . The new teas continue very disappointing, so also are musters by latest arrived mail. Public Sales.—From the 5th to 29th instant 18, 290 packages were offered; prices are flat and depressed, and in favour of buyers, except for good old parcels *Ceylon tea.*—During same period 4,559 packages were offered; the quality generally is undesirable and poor, good lines sell well. *Java tea.*—Sales have been 4,718 packages, which passed without change in prices. *China Tea.*—Rather more business has been doing, but at low prices, and chiefly at public sale; the finer grades are not in much enquiry. Calcutta.—The market is considerable firmer for all desirable teas, but common and inferior are depressed. The crop is reported to be a very large one, and the quality generally poor.

*

SALTPETRE AS MANURE FOR WHEAT.—Mr. Hossein, Assistant to the Bengal Dirotor of Agriculture, Bhagulpore, made similar experiments with saltpetre as a manure in Bhagulpore, the results of which were not so satisfactory. They, however, also show that saltpetre applied at the rate of one and half to two maunds per acre will give an increase of yield which more than pays the cost of the manure. Applied in excess of that quantity, saltpetre as a manure did not pay. Mr. Allen Agricultural Officer, Bankipore applied crude saltpetre at the rate of 1½ maunds per acre, mixed with an equal weight of dry earth. The price of the crude saltpetre in Patna bazar was Rs. 3 per maund, or Rs. 4 8 per acre. The increased yield, due to the application of the manure, is 13 maunds valued at Rs. 30, thus showing a profit of Rs. 25-8 per acre. One year's experiments, it is true, *prove* nothing; but the results, so far as they go, are very encouraging, the outturn of Buxar wheat on a plot manured with crude saltpetre being, it will be observed, 34½ bushels per acre, which would be considered a very good crop on good soil in England. It may be here remarked that saltpetre is a forcing manure, and the continued application of it may lead to exhaustion of the soil; but, as Mr. Allen thinks, the exhausting effect will not be apparent for many years, and may be counteracted by green soiling once in five years. He accordingly advises the application of saltpetre as a top-dressing when the crop is a few inches high, followed by irrigation. Next to saltpetre, the best results were obtained from green soiling with hemp.

* * *

COLOR OF WHEAT.—As to the effect of different soils in changing the colour of the grain, there appears to be no doubt that wheat brought from a distance will, under the influence of the soil and climate, gradually change its character. The Committee of the Wheat and Trade Association report that the white Cawnpore wheat supplied to the Committee and introduced by Mr. Hossein into the Bhagulpore Division deteriorated in colour, and this result is in accordance with the general opinion of the cultivators in the wheat-producing tracts. In connection with this point the Sub-divisional Officer of Barh reported in 1884 that the cultivators of that sub-division understood the superior value of white soft wheat, but it will only grow on certain soils, and if sown on the soil known as teliya kewal

will, they alleged, turn to red. Dr, King, Superintendent of the of the Botanical Gardens, explained the fact; supposing the cultivators' opinion to be well-founded, by the theory that teliya kewal is more suitable for red than for white wheat, that the few seeds of the red sort that were mixed with the seed grain or remained in the field probably throve better than the white, and thus produced a larger proportion of seed. This process probably went on for a few years, when the major part of the crop became red, and the belief thus arose that the soil caused the white wheat to change to red. Mr. Macpherson, in reporting on the point, after enquiry in Nasarigunge, expresses the opinion that the degeneration of white wheat into red on certain soils is so universal that Dr. King's explanation will not suffice. Whatever the explanation may be, there can be no doubt of the fact that the white doodhya wheat which grows well on balsundar degenerates when grown continuosly in kewal (stiff clay) soil. Experiment will be made in order to ascertain under what conditions the degeneration occurs, and how far it can be obviated by importation from time to time of fresh seed.

* * *

THE ROYAL AGRICULTURAL COLLEGE.—In connection with the holding of the Gloucestershire Country Show in July last in Earl Bathurst's beautiful park, Cirencester, is an interesting circumstance well worthy of remark. The show-ground being almost contiguous to the Royal agricultural College the happy thought occurred to the principal, the Rev. J. B. McClellan, that many of the show visitors would like to see the college, together with its museums, reading and class rooms, laboratories dairy department, and the interesting botanical gardens, wherein are to be found so many curious and rare horticultural specimens, herbs, and grasses. The college and all appertaining to it, including the workshops, smith's forge, and veterinary hospital were all thrown open to the public, who were allowed to inspect likewise the College farm, occupied by Mr. Russell Swanwick, and all the valuable live stock belonging to that eminent breeder. Some of the best of these were, of course, in the showyard itself, where Mr. Swanwick won several prizes with Cotswold sheep and Berkshire pigs, his hunter mare, Currer Bell, also having a first prize, whilst some of his Clydesdales were honourably noticed. Mr. Swanwick, can boast of having won upwards of 200 prizes with his Cotswold sheep alone during the past nine years; and we need scarcely observe it must be of immense value to the students to have the development and management of such a well-bred flock continually under their eyes, as well as being able to watch attentively Mr. Swanwick's strategy and good judgment in bringing farm stock to perfection.

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TRADE OF INDIA.—During the past three months ending June 30th, the total value of imports excluding treasure amounted to Rs. 14 81,71 506 and the total value of exports Rs. 24,80,69,650. In both imports and exports there was an increase of more than two crores of rupees over those of the corresponding period of past year. The gross amount of import duty collected including salt was Rs.50,34,680 and export duty Rs. 19,06,497. Among imports raw materials and railway plant show considerable decrease and among exports articles of food and drink considerable increase

1. Anallysis of Crop Experiment in the Bombay Presidency for 1884-85 : From the Director of Agriculture, Bombay.
2. Memorandum on the Prospects of the Cotton Crop in the Punjab : From the Government of India.
3. Report on the Alon Farm in British Burmah . From the Government of India.
4. Annual Report of the Department of the Revenue Settlement and Agriculture 1884-85, Madras · From the Government of Madras.
5. Report of the Nagpore Farm in Central Provinces: from the Commissioner, Central Provinces.
6. Journal of the Madras Agricultural Students' Association for March 1886 : From the Association.
7. Returns of Railborne Traffic for the quarter ending 31 March 1886: From Commissioner, Central Provinces.
8. Memorandum on the Prospects of the Wheat Crop in the Punjab · From Punjab Government.
9. Forecast of Jute crop in Bengal to the end of July 1886: From the Director of Agriculture, Bengal.
10. Report on the External Trade of Bengal with Nepal, Sikim and Bhutan for 1885-86 : From the Bengal Government.
11. Return of the Railborne Trade of Bengal during the quarter ending 31st March 1886. From the Bengal Government.
12. Report of the Agri-Horticultural Society of India, for August 1886 : From the Secretary.

Thanks of the Editor are recorded for the above contributions.

GARDEN CULTIVATION IN THE MAHIM AND BASSEIN TALUKAS OF THE THANA DISTRICT.*

In striking contrast with the wide stretches of rice land, is a narrow belt of rich garden, never wider I believe than 3 miles, running along the sea border of these two talukas. The belt is not continuous, because here and there one or other of the two essential conditions of (1) sweet well water and (2) a light easily worked soil is wanting. The gardens are studded with cocoanut and palmyra palms, and in places divided one from the other by excellent quick fences bounding pretty lanes. The contrast is more striking in the hot weather. Side by side are the bare rice fields with numerous black patches—the nurseries for the seedlings of the coming crop on which the "rab" has been burnt and the garden belt rich with betel-vines, plantains and sugarcanes.

At Mahim the cultivation of these gardens is peculiarly interesting. The length of the rotation and the regularity with which the crops follow each other are remarkable. In Bassein there is greater variety. I propose first in some detail to describe the course of cropping and the treatment of the various crops at Mahim, and then to show how Bassein differs. My acquaintance with the garden tract is imperfect, and the notes now to be recorded were collected at the towns of Bassein and Mahim, and in their immediate vicinity only. I think however that they will give a fair idea of the conditions of the whole.

Mahim.

There are two chief rotations. The one occupies a period of no less than 7 years. The order, never varying, of the principal crops is (1) betel-vines, (2) ginger, (3) sugarcane and (4) plantains. The other, a 5-year course, only differs in the omission of the betel-vine. The gardens are not large, but vary between 5 and 7 acres—each watered by one or more Persian water-wheels. They are greatly subdivided—a fact due to the expense and difficulty of extension. Each cultivator grows all the crops of the rotation, and in order that he may profit by rise in price of any particular product, he divides his land so that he may yearly have plots of each stage of the rotation.

The following abstract will make this clear:—

Plot.	Aspect in October.	Aspect in May.
	New vines just planted.	Vines 6 months old just layered.
	Vines 1 year old giving 1st picking of leaves.	Vines 18 months old in full bearing.
	Vines 2 years old about to be dismantled.	Ginger just put in.
	Ginger crop standing 5 months old.	Sugarcane just planted.
	Sugarcane crop standing 5 months old.	Fallow being prepared for plantains.
6	Plantains about 2 months old.	Plantains in flower or forming fruit.
7	Plantains which have fruited.	Fallow just rabed for rice or *nagli* seedlings.

* Province of Bombay.

I.—The Betel-vine (Piper betel).

In the hot season (May) before the vines are planted, the whole area is *rabed* i. e., cow dung with overlayers of grass, leaves, and refuse by-products of the garden crops spread and burned. With the first fall of rain rice (or in places nagli) is shown. As soon as the seedlings have been removed and planted in the fields outside the garden belt, i. e., in July, the land is ploughed, cross-ploughed and harrowed with the *ali* (elsewhere called *alwat*). In this region of very heavy rain-fall, nothing but easily drained soil with a large admixture of sand could bear this treatment. The rice fields of clay at this time of the year are ploughed and harrowed, it is true, but are meanwhile covered with water. The garden land is easily worked both in the heaviest rain and in the hot season with the help of a little well water, while the rice land is as hard as brick.

The vines are put down in October. The land is marked out into series of alternating ridges and furrows—beds (*arki*) are dug deeper at intervals along the furrows—each about 1 foot square for the reception of the cuttings. They vary from 3,600 to 5,000 per acre. A rough shelter stage is then erected to protect the young vines. Coarse grass is spread over it. The uprights are bamboos (*banakas*). One row outside the area to be planted and one upright at each corner of each bed. These latter serve also as trainers to the vines. Plantain suckers are planted regularly—one to 4 beds of vines. The cuttings are the top shoots of old vines. Six are put into each bed. The four corner ones are trained up the bamboo standards; while to receive the two others, reeds (*karvis*) are put in when required, i. e., in about March.

After the monsoon has set in, the vines are layered. The rough shelter stage is made permanent. Cross pieces of bamboo (*velu*) are firmly tied with locally made coir twine.

An insignificant picking of leaves is secured at this period.

In September an upper stage is added about 5 feet above the lower, which is itself as high from the ground. As the vines grow they are tied with strips

of the plantain stem to their trainers. The bundias are long and overtop the upper stage. The karvis suffice to carry the vine only to the lower one. Thence the centre vines are trained to two of the bundias, which thus carry each two vines.

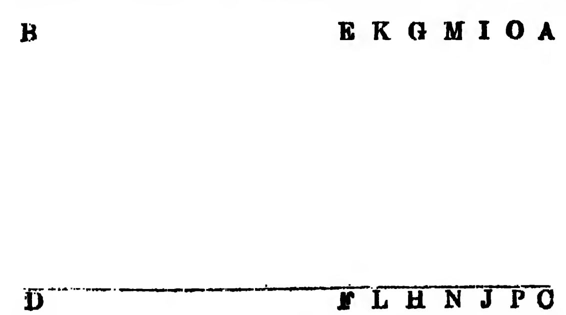
Both stages serve to support the trainers, and the whole frame-work is protected from the violent monsoon winds by transverse stays (rafters of the *bhendi* tree usually), one end resting on the ground and the other on the lower stage. The gardeners mount by the help of these rafters and climb along the lower stage when tying the vines to their trainers or when plucking the leaves.

The first regular crop of leaves is secured in October—just one year after planting. But it is not removed till a buyer appears. After this pickings are made at irregular intervals, as the demand arises, for a full year. Then when cuttings have been taken for the next plot to be planted, the plantation is dismantled. About half of the cross *velus* are fit for use again. But the bundias and karvis only serve as cross pieces for the next temporary shelter stage, and are then burnt.

The plantain is indispensable in a betel-vine garden. It fruits in the monsoon, and is removed, one sucker (*bijkel*) being allowed to grow and replace it. By the time the vines are dismantled, this sucker has grown up and fruited and another is ready for the new plot of vines. The variety of plantain grown with the vines is called at Mahim the "Soneli" and at Bassein the "Narsingi" a long, green, thick-skinned kind which at Mahim is never grown in a regular plantain garden.

II.—Ginger (Zingiber officinale).

The betel-vines are dismantled at the end of the monsoon and ginger follows. It is put down in May. The land is watered, ploughed, cross-ploughed and harrowed. I watched the operation of planting the sets. The gardener measures the beds with a rod 4 feet long and a line. The line is stretched to the full width of the plot AB, and a furrow dug



inside with the garden hoe—an implement peculiar to this tract. The furrow is planted with sets by a man stepping along it, placing a set at his toe, while his heel touches the set put down before. The sets are thus about 10 inches apart. The furrow is immediately covered. From one end (A) a length of 3 rods (12 feet) is measured at right angles and the line stretched from the point reached (C). A furrow is dug parallel to the first made furrow and planted. Cross furrows a: then made. First from A to C, then from E to F, one rod (4 feet) apart. These are planted. The intermediate space is divided by the eye and furrows GH and IJ are made and planted. Each interspace is again divided by furrows, KL, MN, OP. In making these, the sets in other furrows are covered and when made they in their turn are covered. One complete bed is then ready (4 × 12) with rows 8 inches apart. It contains just 100 sets. At this rate an acre will contain 90,000 sets. The earth all around the bed is then slightly raised, and a ridge formed by hand. One maund (28 lbs.) of sets is considered necessary for eight such beds. This gives 112 maunds, or 28 cwt. per acre. Turmeric is planted on the ridges surrounding each bed, and when the ginger is about a foot high, *i. e.*, in July or August, alternate rows of brinjals and chillies are sown in lines one rod (4 feet) apart with here and there a *konphal* (Yam Dioscorea). Brinjals are sown also all round the ginger plot.

The ginger is not dug up till a purchaser appears, generally about February or 9 months after planting. Some gardeners who can afford it, by using more manure force the crop and find a ready sale at a high price as early as November. The weight of the crop is in such a case much less than it would be, if left till February. The haulms of the ginger are used as a rab material, after first being piled round the stems of plantains, as will be described.

III.—Sugarcane (Saccharum officinarum).

Next follows sugarcane—of the red variety invariably. It is planted in May. The preparation of the ground is exactly the same as for ginger. The beds are differently laid out. The rod used is 8 feet long. First a width of one rod is taken, and parallel furrows 8 feet long are made to the full width of the plot. The distance from centre to centre of the furrows is about 2 feet. Along the side of each series of alternating ridges and furrows, water channels 1 foot wide are dug. The unit of measurement in cane cultivation is the *walti*. A walti is half the length of a furrow (*i. e.*, 4 feet) and its ridge. The distance between the rows varies slightly with the character of the soil.

In the diagram below ridges are shown by thick black lines, and furrows by the intervening spaces AB=8 feet, AC=1 foot. Taking the water

channels into account there are (with rows 2 feet apart) 4,840 waltis per acre. The local estimate is 5,000.

-C

The sets, which are canes cut up into lengths of 6 to 8 inches long, are laid along the furrows—about 4 go to one walti. An acre will contain 20,000. As they grow the canes are thinned, and only 5 shoots at most are left to grow up in each walti.

The seed cane is grown separately in rows very much closer together than in the regular crop. As the cane throws out leaves after the thinning, the lower leaves are wrapped round the parent stem and tied. This serves to protect the cane from Jackals and prevents side shoots which would weaken the growth.

The standing crop is sold to traders about 9 or 10 months after planting. The sale price is settled per 1000 waltis. But by custom the seller has to count out 1,100 waltis after the canes have been cut, and to make up the difficiency elsewhere if that number is not reached in the cut plot.

Gul (*goor*) is not made except from damaged cane. The traders take the cane to Bombay.

IV.—Plantains (Musaparadisiaca)

Last in the 7th-year course comes plantain. As the Soneli is the variety almost always grown in the betel-vine plantation, so Rajeli (long tapering, and yellow skinned) is the variety grown in the plantain garden. Here and there the "Basrai" is coming into use. It is smaller and of low growth, and does not require props to protect it from heavy wind. The red plantain of Bassein is not seen at Mahim. The suckers are put into the ground, prepared as for the other crops of the rotation, though without watering, in August.

It is a great point to secure the bunch of fruit on the side opposite to that of the prevailing monsoon wind, which is heavy when the fruit is forming. Some gardeners assert that this can be effected by knowledge of the fact that the fruit forms on the side which was nearest to the parent tree and so in planting the sucker, this side is carefully turned to the north-west.

The suckers are planted in carefully made lines from 8 to 10 foot lengths apart. Each sucker is equi distant from the next in the line, and from its neighbour in the adjacent row. Taking the foot length at 10 inches, there will be 600—1,000 trees per acre. The number varies with the soil. In good land the trees are closer. As the trees grow the trunk is protected by rice straw, ginger haulms and the like piled around it. Water is not applied directly, but is collected in small depressions in the centre of the square bounded by 4 trees, and thence sprinkled by hand. Till the commencement of the monsoon following the planting, no supports are needed. But they are required—one to each tree—while the heavy bunch of fruit is forming. When bamboos were obtained free from the forest, they (*tokars*) were used. Now however recourse is had to the shoots from pollarded bhendi trees. A crop of such shoots strong enough to support the tall plantain tree is got once in four years. They are beautifully straight, and as many as 100 are sometimes obtained from a large bhendi. This tree is very plentiful and is being pollarded far more extensively than formerly. Other trees, *e.g.*, *karvati*, *kankul* and *pangara* have lately been similarly treated, but the results are poor compared with those obtained with the bhendi. The shoots are neither so straight nor so long and do not grow so fast. The pollarded tree does show a gnarled trunk, but the yield in a very useful form is largely increased. The tree gives a crop once in four years instead of one large one when it is cut down, and there appears much in the contention of the people that similar treatment of forest trees to increase the available fuel supply is worth consideration. Tokar props last three years. The bhendi prop lasts as long, if it is let into the ground. It has however after one year to be taken to another plot and lasts for 2 seasons as dead prop. The use of the bhendi for betel-vine cultivation in lieu of dead supports, which necessitate so short life to the vine, at once suggest itself. But it does not seed in this tract and therefore cannot be grown as pangara and other trees are in Dharwar, etc., for betel-vine trainers. If small cuttings are planted, it is said that they grow slowly and do not keep pace with the wine.

The plantain grower seeks to cause the trees in a plot all to ripen fruit simultaneously. This is secured (with the rajeli) by selecting suckers of the same age. The plantain bears its fruit in the monsoon. It is said that the Mahim sailors used to be venturesome enough to take boat-loads by sea. But now the produce is sent by rail.

The plantain is liable to disease as all other plants are. But if one dies, it is still carefully propped in its place, lest a gap should be open for the fierce wind to the destruction of healthy neighbours.

The plantain garden is dismantled in November. The stem is stripped for twine and the midrib of the leaves gives a particularly strong ligature used to bind together the buckets of the water-wheel. All otherwise useless portions find their way to the rab bed. The rotation is now completed. It fills a period of 7 years, and begins again with the "rabing" of the plantain area in the next hot season. For this rab, the only material which has to be brought from outside the gardens is grass, but owing to the abundance of leaves the amount of grass required is not very large. At Mahim sugar-cane stalks from which the juice has been squeezed are not available as the cane is exported whole.

The rice and nagli seedlings raised on the "rabed" area are often taken to great distances to the fields outside the garden belt. A sort of draw sledge is used, which is early drawn over the embankment of the rice fields. Those rice fields which adjoin the garden area are styled *khal*, literally "below." In this khal when water from the well in the garden is available, sweet potatoes are grown.

The 5-year course differs only in the absence of the betel-vine. It is practised where the vine does not succeed well.

Manuring.

The almost universal manure is castor-oil cake imported by boat (chiefly) and by rail from Gujarat. Cow-dung and vegetable refuse are used for the periodic "rabing" of the garden plots as described above. The manure is paid for in cash by those who can afford it, but the poorer gardeners are supplied by traders who charge a heavy interest. It appears to me that there is an excellent opening for an artificial manure in this tract such as that patented by Professor S. Cooke of the College of Science, Poona.

I.—Betel vines.

In December when the cuttings begin to throw up shoots, a very small amount is applied to each bed (arki), *viz.*, ½ a tipri, or 3½ tolas in weight. This comes however to 350 lbs. per acre. The second application is made when the vines have started into fair growth and require support *i. e.*, when the karvi uprights are put in. In amount it is double the first dose. When the vines are loosened, coiled and layered, a still larger application—double the last—is required. The gradual increase to his maximum regulated by the capacity of assimilation by the vine is noteworthy. From this time till about a month before the last crop of leaves, this application is repeated. In all from 15 to 20 doses are given and and the total per acre comes to from nine one-fifth to 12½ tons or from 35 to 48 local khandis, costing Rs. 8 per khandi, *i. e.*, no less than from Rs. 280 to 380 per acre.

II.—Ginger.

This crop is manured thrice *viz.*, in July, August and September, at the rate of 3 lbs., 3¾ to 4½ lbs., and 4½ to 6 lbs. per bed (*vapha*). The cost is from Rs. 136 to Rs. 166 per acre and the amount from 4½ to 5½ tons. The larger amount is used when the crop is forced for an early market in November.

III.—Sugarcane.

Three applications are made in the same months as for ginger. The amounts are per 100 beds (walti).

By measure.	By weight.
1st—10 adholis. *	1 maund. †
2nd—11 „	1¼ „
3rd—12 „	1½ „

The manure is always bought by weight, but is applied sometimes by measure and sometimes by weight. The results are practically the same and come to a little over 8 khandis or two one-fifth tons per acre, costing Rs. 66.

IV.—Plantains.

This crop receives manure twice—once shortly after planting and again in November, or else thrice in September, October and January. In the former cases the amount per tree each time is 3 lbs. In the latter, it is 1½ lbs. 2¼ lbs. respectively per tree. The cost and amount per acre will be—

600 trees…1½ tons	…Rs. 45		a. p.
to	to	to	or 1 2 per tree.
1,000 trees…2½ ton	…Rs. 75.		

Watering.

All irrigation is from wells which are either built in masonry with a diameter of about 13 feet or else are wide hollows with sloping sides. The latter are called *baukhal*. The water-lift is the Persian wheel (*rahat*). It costs about Rs. 400 to erect a wheel over a baukhal. All the parts which are exposed to the rain, or which dip into the water must be of *khair* wood (Acacia catechu). The main shaft (*chat*) which joins the revolving wheel (over which the buckets lie) to the vertical toothed wheel, is a strong straight khair beam—over 12 feet in length. The upright shaft (*ubhak*) of the horizontal toothed

* 1 adholi (measure) of cake=3 lbs.

† 1 maund=28 lbs.

wheel is also of khair. The bullock (or buffalo works at the end of a lever attached to the ubhak. The length of the main shaft regulates the distance between the pair of cog-wheels and the water-wheel, and so in the case of the baukhal a heavy platform is required in the centre of which is the ubhak. This platform is supported by 9 khair posts to raise it to the level of the centre of the water wheel, and above the highest water level. Two large khair posts support the outer frame-work of the water-wheel. These last only are required in the case of a built well, for then the animal walks on firm ground. Wells can only be substituted for baukhals when the water-supply is good—which is really the case. But they are being substituted owing to the increasing difficulty of obtaining wood—which once was taken free of cost from the forests.

Both in Mahim and Bassein improvements in the gearing of the lifts are being tentatively tried. At Mahim Mr. Dhondo Vinayak Dandekar has introduced a chain pump worked by an iron shaft to the outer end of which is attached a small iron cog wheel, working into the horizontal wheel to which the lever is attached. This effects a great saving and probably will deliver a large quantity of water in a given time and at a given cost. Its working is being watched with interest, and imitation will surely follow if the improvement stands the test of long trial. The improvement can be utilized both in the well and the baukhal, but it does not do away with the necessity of the huge platform in the case of the latter. The Bassein improvement lays claim to the merit of abolishing the platform. The inventor, Mr. Rambhav Maratha—a man of undoubted mechanical genius which has exhibited itself in many directions—does away with the main shaft altogether. The axle of the water-wheel instead of being continuous with the main shaft is at right angles to its direction. The wheel works towards the centre of the bullock gear instead of in the plane at right angles to it. Over the wheel is a heavy rope—the substitute of the main shaft. The rope which is endless is brought round a horizontal grooved wheel resting on a strong upright post permanently attached to it. A lever is fixed into the post below the wheel and to this the draught is attached. Friction keeps the rope from slipping. This improvement has already been adopted in 3 places at Bassein. The danger appears to be that, when the groove has been worn smooth, the rope will not bite; but the inventor says that this can easily be avoided. The substitution of the rope for the shaft makes it possible even in the case of the baukhal, for the animal to work on firm ground.

The cost of the whole apparatus, including the platform, in each improvement is calculated to be under Rs. 100.

A first sight I thought that the Burgess' bucket lift would fill a great want in this garden tract, but further study showed that it is unsuitable.

First the water-supply of the wells is generally very small and the bucket lift could not work at any rate with profit as the Persian wheel or chain pump can in water less than 1 foot deep. Secondly, with the Burgess' lift the bullock works on a stage covering the mouth of the well. It would cost a great deal to cover a built well or to erect a stage in the centre of a baukhal. Still by digging a small well beside the large one and by joining the two at the bottom by a pipe, the Burgess' lift could be used, provided the water is sufficient to make its superior lifting power pay. After this digression, I proceed to describe the irrigation of the various crops of the rotation.

I.—Betel-vines.—From the end of the rains the vines are watered every 6 days, till the first application of manure. From the 3rd day after this manuring till the commencement of the succeeding rainy season, each bed is watered once in 3 days. In breaks during the monsoon, the watering is continued and after its close till the last picking.

II.—Ginger.—The land is watered to make ploughing easy. Next day while the moisture still remains the sets are planted. Watering is continued from that time at intervals of 3 days as in the case of the vines till the crop is ripe.

III.—Sugarcane.—Water is required to soften the ground for ploughing, and on the day after the sets are planted—again 3 days afterwards. After this every 6 days, unless there is rain, till the crop is pulled.

IV.—Plantains.—As soon as the rains are over, the garden is thoroughly cleaned of weeds, and the water-channels made. Watering is required every 5 or 6 days. The quantity of water given to plantains is greater than that required by the other crops of the rotation.

In busy seasons (as May) the water wheels are worked night and day, by each sharer in the garden in his turn. On the average 4 acres of garden are watered from one well.

The gardeners live in very well built houses always in the midst of the garden. Those who have capital are very well off. Most own rice land. Those who do not, cultivate land belonging to those classes who sublet. I saw one of the best farms in Kelva, which adjoins Mahim. Nothing could exceed the cleanliness of the cultivation. The

plough-cattle chiefly he-buffaloes—are in good condition, and the byres are better than I have seen elsewere. In the particular farm referred to the flooring is made of spilt logs of the cocoanut palmyra palms—with the rounded part uppermost—placed on the slant to secure drainage. The upper side is open to the inner part of the house, where the gardener sleeps with his cattle in sight.

The absence of live standards in the vine cultivation and the use of bamboo branches and tops for fencing the gardens, are points on which I believe improvement is feasible. The dead standards only last long enough to give the vine a short life of 2 years, and in order to make it repay cultivation it is forced by very heavy manuring to bear its first crop in 12 months, and to yield during the cropping season enough to cover the very heavy expenses incurred. Then its supports rot and give way. With live standards I firmly belive that large saving of manure without diminution of profits could be effected—for there is no reason why the vine should not bear for at least 5 years. The margin of profit would probaly be greater, for the frequent erection of stages together with the cost of carriage of material, added to the price could be avoided Again as regards fences—in Bassein every garden is surrounded by strong quick fences—chiefly of *karwand* (Carissa carandas). These last for generations, and the trimmings made once in 8 years, form a valuable addition to the rab beds. Properly cared for, the hedges do not rob the gardener of any of his valubale land. In Mahim all the fences are made of the otherwise useless parts of the bamboo. But they require removal every year at a considerable cost of labour and carriage, and at best give a miserable fence. All climatic conditions are indentical at Mahim and Bassein, and I see no reason why the hard-working Mahim gardener should incur the expense he now incurs in clinging to his wretched fence, when it is in his power to raise a lasting and beautiful quick hedge. All the gardens are interspersed with the betel,cocoanut and palmyra palms. Now and then fine jack fruit trees are seen and less often tamarinds. The fences are lined with bhendi trees and all vacant spaces round wells and houses grow this useful tree.

Shirgaon Gardens.

The description above given refers to the large villages of Mahim and Kelva. I visited the next village Shirgaon and was struck with the contrast. The difference is due to deficiency of water in the wells, and to a greater admixture of sand in the soil. Here there is no regular rotation. In better land, plantains, chiefly of the Mutheli (short, plump, sweet and yellow skinned) variety are grown with manure and irrigation. The garden is kept 2 years under plantains, suckers being allowed to replace those which have fruited. At Shirgaon this variety of plantain seldom requires props. It does not grow so tall as elsewhere. In the hot season, after the second crop of plantains has fruited, the ground is cleared and rabed. Rice seedlings are raised, and radishes put in about October. Else the land is left fallow. The year after, *tag* (Bombay hemp, crotolaria juncea) or *udid* (Phaseolus radiatus) is sown as a late rain crop without irrigation or manure. After this the land may be able to receive plantains again or sometimes chillies (Capsicum frutescens.) The plants are raised in a nursery (sown in September), and planted out in about 6 weeks. They are watered every 4 days—the first watering being given 3 days after planting. The crop is manured once with a mixture in equal quantities of (1) sheep or goat-dung, (2) dried fish pounded, (3) castor-oil cake—in December or January. The plants are put in regularly in rows 3 feet apart—not by measurement. In the row the distance between the plants is about $2\frac{1}{2}$ feet. Six plants, 3 in each of two adjacent rows, form a bed (*bandhni*). In each bed a plantain sucker is set. Three adholis (1 adholi=approximately 3 lbs in this case) of the mixture are applied per bed. Half is put around the plantain sucker and the rest near the roots of the chilli plants. Water channels are dug round every 4 beds, and on the sides of the channels *vangis* (Solanum melongena) are sown.

[I noticed that in many gardens the *vangis* were attacked with a parasite of the broom rape family. It is very common on tobacco in Gujrat and the Southern Maratha Country and on *vangis*; in fact, as pointed out by Dr. Shortt of Madras attacks all the Solonaceæ. Strange to say it is not well known in Bassein, and is said by the people to have been unnoticed till recent years. It has no name with them. In Gujrat it is called *vakumba*. It is called *bambaku* in the Deccan.]

Sugarcane is grown sparingly. Gul is not made. Its cultivation is very similar to that of Mahim. Manure is applied twice or thrice, if the crop shows signs of distress. The manure is oil-cake.

The poorer land is never rabed. It is too sandy. I did not record full notes for the cropping. *Vangis* are grown followed in the early rains by turmeric interspersed with yam-vines (Dioscorea—Konphal). In each bed of turmeric (irrigated and manured) about 5 feet square, two vines are put down in the water-ways. A bhendi prop is placed half way between them, and both vines trained on to it. Next year tag is grown as a rain crop without manure, or else after a fallow till August or

September, udid is sown. The former crop after it has seeded is sold standing to fishermen, who cut it to make fibre. The udid is cut green as a cattle fodder in the hot season. These are both restorative crops. Next year, if a fallow is not necessary, radishes are sown in October. Next year again only tag or udid are possible and then vangis are taken again.

Sweet potatoes are grown extensively in the rice fields (*khal*) adjoining the garden area and so capable of irrigation from the garden wells. They are put down in November and lifted in May. Onions are sometimes grown in similar land.

Bassein Taluka.

The garden area in the Bassein Taluka is very much more extensive than the Mahim. There are gardens in 29 villages. My observation was limited. Numerous varieties of plantains are grown—the best known of which is the red plantain, which is a great favourite. Sugarcane is also largely cultivated, but betel-vines in a smaller proportion than in Mahim, and with considerable differences. The gardeners are chiefly Christians. The first remarkable point is that the gardeners divide themselves into (1) betel-vine, (2) cane and (3) plantain growers, and show much reluctance to give even the most ordinary information about any but their own special crops. Some few combine these staples but keep the cultivation of each quite distinct, and exhibit a remarkable departure from the sustained rotation of Mahim and Kelva.

The betel-vine is grown continuously. Cuttings from old vines are planted in October after a crop of rice or nagli seedlings has been raised on the area rabed during the previous hot season. In the June or July following the vines are layered. The first crop of leaves—save a small picking made before layering—is taken in August. Pickings are made monthly or oftener for 15 months. The best vines yield 20 and the poorest 12 pickings in all. The plantation is dismantled in December and till the new plantation is made in the October following, the land lies fallow except for the catch crop of rice or nagli seedlings raised in the early monsoon after rabing in the hot weather. Each gardener divides his land into 3 plots, so as to have a new plantation yearly. In Bassein instead of an upper and lower stage, a single stage is erected. There is less regularity in the planting than at Mahim, though the gross number of vines per acre is about the same. Instead of placing the cuttings in small beds at intervals, they are arranged on either side of small furrows 6 feet long, at distances of about 10 inches apart. The ridge between the furrows is wide. The centre of one furrow is 4 feet from that of the next. Water-channels (1 foot wide or more) run along each side of a series of alternate ridges and furrows, and each ridge is divided half way to form a small distribution-channel. The double row of vines along a furrow is called a *haral*. There are about 600 *harals* per acre. The leaves are packed for sale in packets (*katal*) of 50 leaves, and the baskets in which the leaves are sent by rail contain from 120 katals of large to 160 of small leaves The manure is castor-oil cake, at the rate of 6 lbs. per haral at six different intervals or 10 tons per acre—costing Rs. 300; and the irrigation from Persian wheels.

Plantains.

The varieties are 1 rajeli, 2 basrai, 3 red (tambdi), 4 mutheli, 5 narsingi, 6 bankheli, 7 goyagiri, 8 kaijeli. All these except the basrai grow very high—15 to 20 feet, and require props during the fruiting season. The basrai is of recent introduction. It needs no props and is much liked.

The distances apart at which the principal varieties are planted are measured by foot lengths which may be taken at 10 inches:—

	Distance from tree to tree.	No. of trees per acre.
Basrai	6 feet	1,200
Rajeli ..	7 „	900
Narsingi	8 „	700
Tambli ..	10 ..	450

Manuring.

The red variety takes the most manure—1 adholi (3 lbs.) of oil-cake per tree—at each dose. The others receive only half this amount. Moreover the red are manured 4 times and the others three:—

	Cost per acre.	Amount of manure
Basrai	72 Rs. for	48 Cwt.
Rajeli	54 „	36 „
Red	72 ..	58 „

The first two are sold wholesale at about Rs. 30 and Rs. 40 respectively per 100 bunches (*longar*) *i. e.* per tree. The red plantain gives a much larger bunch. Wholesale they fetch Rs. 80 per 100 bunches —while retail they fetch as much as Re. 1 per 100 plantains in season. The rajeli is the only variety from which dried plantains are made (Thana Gazetteer, Vol. I, p. 292).

The increasing cultivation of the basrai is due to several facts—

1. The great saving in the props required for other kinds ;

2. The increased demand for a sweet cheap plantain.

3. The saving in cultivation—less water—larger number of trees per acre.

Whereas the other varieties require water every 6 days, the basrai, preventing evaporation by the extent of leaf and thorough shelter due to its compact growth, needs irrigation only once in 8 days.

It is alleged that the rajeli is by far the most remunerative kind, but that its cultivation is diminishing in favour of the basrai on account of the charge made for standards. There is however ground for thinking that the basrai variety is the more remunerative, and as its value is becoming better known its cultivation is extending. No doubt the saving in standards is very considerable. If the cultivation of rajeli variety can only be made to pay by the supply of props free of cost, it should and must be abandoned, or else the people should pollard the bheudi as is done at Mahim, but not in Bassein.

The suckers are set out in June. The fruit is ripe in about 12 months, but some trees go on ripening till November. The stumps are cut down in January or February and the roots removed. The whole area is then rabed and a new plantation is made in June or July. Rice or nagli seedlings are raised in the intervals between the young suckers. In some places the new plantation is delayed a year. When this is the case the rabing is also delayed, and a crop of vangis is taken, or else udid as a fodder crop.

Sugarcane.

The crop is grown once in 3 years. After the crop is pulled in the hot season (May) one year after planting, a crop of rice from seedlings raised elsewhere is taken. The rice is followed by a late crop of wal or udid for fodder. When the fodder has been consumed, the land is rabed and in the next monsoon rice seedlings are raised and followed by a rice crop in the same area. This is reaped in November, and is quickly followed by udid, gram or sweet potatoes. The last require irrigation. In the April or May following, new canes are planted. The cane is laid down as at Mahim, but, instead of being cut after 9 months, is allowed to mature in 12. It is then pulled and gul is made. The crushed cane is the most important constituent of the rab, which once in the rotation of 3 years is burned on the sugarcane land. The manufacture of gul is made with the use of fuel fetched at privileged rates from the forest lands. The juice is boiled down in a deep narrow copper pan, which experiment clearly showed to be far from economical in fuel, when compared with the wide shallow iron pan used in Gujrat and the Deccan, where fuel is much more scarce and where no privileged rates are known.

The quality of the gul is very good, and the merit of lasting a long time without becoming soft is claimed—a merit which I am now testing. The variety of cane is red. The unit of measurement is the bed (walti) as at Mahim. About 3 tons of oil-cake costing Rs. 90 are said to be used per acre. The first application is made when the shoots are about 2 feet high in July. At this time the plants are earthed up, the furrows being converted into ridges. The manure is spread along the furrow before it is closed. The second application in September is made when the lower leaves are wrapped round the stem and tied. On this occasion the manure is sprinkled round the roots of each plant by hand.

The first watering is given as at Mahim, to soften the land for ploughing. A few days afterwards the land is ploughed 5 or 6 times in different directions and then levelled, and the furrows dug to receive the sets. Immediately afterwards water is again let on, and the canes are irrigated once in about 8 days till the crop is pulled, except when there is rain.

The cane is pulled in the early morning, and topped and stripped on the spot. The tops are used as fodder. The dry side leaves go to the rab bed. In a plot of 2 gunthas of fair average cane I found 1,428 canes weighing 3,446 lbs. or 2·4 lbs. per cane ready for the mill, and 122 canes weighing 105 lbs. immature and badly coloured. These latter are used to make molasses (*kakvi*) and coarse sugar. The tops from the same area weighed fresh 710 lbs.

Results per acre.

		Weight.
28,500 good canes topped and stripped	...	30 tons.
2,500 immature canes	... ...	1
Tops for fodder	... ...	7
Juice for gul 65% on weight of cane	...	20
„ Kakvi	... ...	½
Gul 16¼% on weight of juice	... ...	3¼ „

This last percentage is very variable. The figure here given is for good average cane pulled at the most favourable time. I did not ascertain the amount of molasses and sugar made from the kakvi. The sugarcane growers make vinegar from the cane sufficient for home consumption, but it is very sweet and inferior and would not pay if made for sale.

Rab.

A short paragraph on the practice of rab in connection with the garden cultivation appears advisable. The invariable use of rab as the first step

towards preparing the land for a new course of cropping must have been noticed, as also the fact that where plantains are grown the rab is burned when that crop has been reaped. I have not found a satisfactory explanation why this is so, but I have no doubt that there is a good reason. Again it has no doubt been noticed that rab is not burned on the poor sandy garden land of Shirgaon. This fact is in complete accordance with the objects of rab as far as they have been ascertained. The rab is used also to raise seedlings of rice and nagli for planting out in land outside the gardens. Where gul is made from cane, the crushed cane is one of the most valued materials. Generally speaking either cow-dung or crushed cane forms the principal layer. No *tahal* (boughs and other loppings) is used on the coast except the trimmings of hedges. All otherwise useless by-products of garden crops find their way to the rab beds.

About 1½ times as large a seeding of rice is required for poor rab, *i. e.*, rab where tahal or cow-dung does not constitute the principal layer, as for good rab, and moreover in the former case a top dressing of the seedlings with castor-oil cake or dried fish (*kuta*) is generally found necessary in addition to the rab.

A considerable area of salt marsh rice land adjoins portions of the garden belt. Where the proportion of salt is small, the land is picked in the hot season with *kudavna*—a long-handled pick—by hand, and left in the rough. The seed is sown with the first fall of rain. Seed—the partial germination of which has been artificially induced,—only is sown. Where the land is very salt it is not touched till it is well covered with water. It is then stirred with the bullock hoe and sprouted seed thrown on the surface of the water. It falls to the bottom and takes root. It stands complete immersion for as long as 10 days.

In some cases the seed is sown on the fields covered with water over a foot deep. The variety of rice is a red one, considered especially nutritious by the poorer classes.

No fact connected with rab in this garden cultivation gives any support to those, who have characterized rab as the resource of a slovenly wasteful cultivation. Far from it, for here we find rab the regular recognized practice, in a tract of unusually high and excellent cultivation.

E. C. OZANNE,

Director of Agriculture, Bombay.

NEWS.

Bengal.

Forecast of the Jute crop to end of July 1886.

Reports regarding the prospects of the jute crop were forwarded at the end of June by certain gentlemen who were selected by the Collectors of districts as having special opportunities of judging of the prospects of the crop in their several localities, but as many of these reports were contradictory and manifestly inaccurate, it was not thought worth while to attempt to frame any general forecast from them. Reports were therefore again asked for as to the prospects of the crop at the end of July, and the reporters were requested to send copies of their forecasts to the Collectors of their several districts. The Collectors were asked to examine the reports when received, and after such examination, and with the information afforded by the mofussil reports before them, to give their own opinions embodying the results of their personal observation regarding the prospects of the crop, the area sown, and the probable outturn. In response to this request, 129 reports have been received up to date from the various jute-producing districts. Of these, 81 have been sent by native zemindars and managers of Wards' and Government estates. Five have been received from European planters and managers of estates, and six from members of the Agri-Horticultural Society. Seventeen sub-divisional officers and the district officers of all the jute-producing districts, except the Deputy Commissioner of Julpaigoree, have forwarded forecasts based partly on the mofussil reports from their districts, and partly on results of personal observation. From Julpaigoree no reports whatever, either official or non-official, have been received. It may be said generally that the rainfall was below the normal in many of the districts during the sowing season from March to the end of April, and that the area sown in these months in such districts was consequently somewhat less than the normal. In Mymensing, Dacca, and Ferreedpore, the young plants were, it is reported, partially injured by insects. In Rungpore, Bogra, and Jessore, a larger area than useful is devoted this year to other crops, and less than the useful area is sown with jute. Rainfall in May, June, and July was in most places full and timely. So far, then, as it is possible to form a forecast from the reports received, it may be said that a crop above the full average may on the whole be expected. The area sown this year under jute in each district is estimated to exceed or fall short of that shown last year, and also the estimated outturn expressed in annas. It is, however, to be remembered that these estimates are founded merely on the *opinions* of the reporters selected, that the estimates of areas sown are mere guesses and are not based on field to field inspections, or on the results of any previous survey, that there are no means of ascertaining either the normal area sown or the area sown in any particular year in Bengal, and therefore that, though the information given is the best available, yet no pretence to statistical accuracy can be made for these estimates.

Punjab.

The prospects of the Cotton Crop.

The first report on the prospects of the cotton crop in the Punjab is as follows:—Condition of cotton crop very good. So far a full average crop is expected.

Bombay is about to purchase a steam threshing machine. The machine was tried successfully at the Government Experimental Farm at Bhadgaon under the charge of a gentleman especially sent out to this country by Messrs. Marshall, Sons, and Co., the makers of the machine. The experiments were chiefly made in threshing wheat, but it can deal satisfactorily with other crops, such as gram, linseed, &c., while the engine can also be used for driving sawings for cotton, crushing sugarcane, pumping water, grinding flour, and sawing wood. The Government of Bombay sanctioned the purchase of the machine for Rs. 5,507, which is to be met out of the annual grant in the interests of agricultural improvements.

School of Forestry—There is no school of forestry in England, but in future forestry is to be taught at Cooper's Hill, with a view of qualifying students for admission into the forest service of India. There is no doubt that the establishing of a regular school of forestry would be splendid thing for England itself, and would have the effect of vastly increasing the value of the woodlands of the old country. There are institutions of the kind in almost every other country, and they have had a most beneficial effect. In proof of this I may mention that about thirty years ago the Landes was the poorest and most wretched districts in France; it has, however, been judiciously planted under the direction of the French School of Forestry, and is now one of the most prosperous regions in the country, the increase in value being estimated at no less than forty millions sterling.—T. E B.

The following letter from Mr. Faucane, Director of the Agricultural Department, Bengal, to the Commissioners of Divisions, will be read with interest:—In forwarding for your information a copy of the correspondence on the subject of the cultivation of wheat in the Lower Provinces, I have the honour to invite your attention to two points of considerable importance which will be found discussed in these papers. These are the great superiority of Buxar grain to the other varieties of wheat produced in Bengal and Behar, and the greatly increased yield which may be expected from the use of crude saltpetre as a manure, or from green manuring by ploughing in a crop of hemp before the wheat is sown. The attention of Managers of Wards' and Government Estates in wheat producing tracts should be called to these points, and it would be well also, I think, if these officers were instructed to try the cultivation of the Buxar variety, at least experimentally, wherever other varieties of wheat are now grown. It will be observed that Buxar wheat is as good as any produced in India and is six annas per maund superior in value to that produced in the neighbouring division of Bhagulpore; while it is believed that the varieties of wheat now produced generally in Lower Bengal are even inferior to the Bhagulpore grain. I shall be glad to procure good Buxar seed for any person who may require it, and shall be also prepared to have samples of the Buxar grain appraised after the cultivation of it has been tried in new localities, by the Trade and Wheat Association and compared with the local varieties. The use of crude saltpetre, and the practice of green manuring with hemp, may also be tried with advantage. Should it be found that the results obtained in the Doomraon demonstration farm from the use of these manners are of general application, it would follow that enormously increased profits would accrue to wheat-growers from having recourse to them as well as from using Buxar seed.

The trials of ensilage at the Cawnpore experimental station, which have now been carried on successfully for more than three years, may safely be said to have carried the case beyond the term of experiment and to have established its success. Last year afforded a very good example of the advantages of the system of ensilage. In the previous year a great deal more ensilage had been stored than could be got rid of, but it was decided to keep it in the silos to ascertain for what length of time it would preserve its good qualities. A favourable opportunity of ascertaining this occurred this year, when, in consequence of the failure of the rains and the short supply of *kharif* fodder, a demand for the ensilage arose. The old silos were opened after their contents had been in them for eighteen months, and it was found that the cattle much preferred feeding on this old ensilage, on which they were kept in excellent condition for two months. The result, of course, was that there was a large saving in money which would otherwise have had to be expended on fodder for the cattle. There was no offensive smell in the fodder from these silos, although we are not told whether this was the result of any special precautions.

The floods in Champaran, Tirhut, and Darbhanga will no doubt be productive of good results to the opium cultivation. Large tracts of country lying on either side of the Sikrana, Bagmati, Pur Gandack, and the many smaller streams which intersect these northern districts have been submerged, and the bhadoi crop is utterly destroyed. These flooded tract will, however, yield a richer poppy crop, and the rayats, eager to recoup themselves for their loss, will resort largely to the opium cultivation, as under similar circumstances they have done in other years.

Mr. Phillips, in lecturing at the Royal Aquarium on petroleum, said that the total shipments of refined oil from America in 1885 amounted to 6,985,637 barrels, of which the United Kingdom received 1,269,723; London taking 653,964 barrels. If the total shipments were placed in barrels end to end, like a string of beads, they would reach from London to New York. It is estimated that the world's consumption of illuminating oil amounts to 1,800,000 gallons every day. At the present price of oil as sold retail and taking an ordinary circular wick burner of forty candle power, it costs about

three-sixteenth of a penny per hour, which was fifty per cent. cheaper than gas. In this connection, it may be mentioned that the Balloon Society of Great Britain is offering a prize for a cheap safety-lamp suitable for universal use. The annual production of mineral oil shale has continued to increase in Scotland, until in the present year it stands at the unprecedented figure of about two million tons.

The net Indian sea and land customs' revenue, exclusive of the salt revenue, for the first four months of the current financial year, amounted to Rs. 38,01,000, as compared with Rs. 37,54,000 during the corresponding period of last year.

The paper manufacturers in Madras do not yet make paper of a sufficiently good quality to enable the Government to dispense with obtaining the greater part of their stores from England; and last year the quantity of locally made paper issued was only 6,630 reams as against 8,308 reams on the previous year. The Government has issued an order that the local manufacturers should clearly understand that, unless their supplies are good and cheap as those obtainable elsewhere in India, further encouragement cannot be expected from the Government.

The Managing Director of the Indigo Company has been trying the ammonia process for increasing the outturn of indigo in manufacture in Tirhoot. The experiment was made at the Belsund Factory and has resulted so far in an increase of 33 per cent. of *mal* over the ordinary process.

Mr. Charles Marvin, one of the first to direct attention to the Russian petroleum fields at Baku, in speaking lately of the transference of petroleum in bulk, said that America was at present the principal petroleum power. By the development of the petroleum fields at Baku, Russia had recently sprung into the position of the second petroleum power; and Mr. Marvin thought that England should come to the front and occupy the third position as soon as possible. By the annexation of King Theebaw's dominions we had come into possession of the Burmese petroleum fields, and he thought steps ought to be taken at once by the Indian Government to survey these fields and to throw them open to British capital and enterprise. Within the last few years since the extension of the railway, considerable petroleum deposits had been discovered in Beluchistan, but he regretted that the Indian Government had decided to make them a Crown monopoly. Still more recently, petroleum in abundance had been discovered in Egypt. Since he wrote in 1882 of the Caspian petroleum fields, eighty steamers had been placed on that inland sea to carry oil in tanks from Baku to the mouth of the Volga; and on the Volga there were upwards of a hundred vessels running. At present, nearly all the petroleum arriving in Europe from America was brought in barrels; several tank steamers were, however, being constructed on the Tyne for the purpose of carrying petroleum in bulk.

We learn that Californians are making exceptional efforts to turn out first rate samples of wheat with a special view to competition with Russia and India for the English market, and last year an association of the principal millers was formed, called the Millers' Association of the Pacific coast. Its main objects are to improve the method of the purchase of wheat, and to bring the miller more directly in contact with the farmer who grows high class wheat. The following remarks made by some of the leading authorities in San Francisco, referring specially to the English market, may have an interest for farmers and millers. Mr. Bannister, vice president of the Corporation Starr and Company, who since 187[illegible] have had a branch establishment at Liverpool, and who make it their speciality to send cargoes of the finest flour, takes a very hopeful view of California prospects as supplying England with flour, and says that it is very difficult for English millers to compete with California millers, as the former, tempted by the cheapness of Indian wheat, generally use it, the consequence being a bitter taste to the flour which is white, sweet, and generally superior. Even when English millers make flour from California wheat, their machinery is, he states, so inferior to that in use in California, that the flour is not equally good. Again, he states that English millers grind the wheat too much. He adds that, after careful calculation, he is confident that wheat can be laid down by small growers at tide water at 3s. per cental of 100 lbs., and that large wheat growers can afford to do it at 2s per 100 lbs. This firm shipped to England during the first four months of the harvest year nearly 150,000 barrel of flour. A somewhat different view, of the prospects of English millers is taken by Mr. Horace Nash, of Golden Gate mills and president of the Farmer's Association. He states that the margins of profits were never so close as throughout 1885, owing to many new mills having been erected and improved machinery having been placed, causing greatly increased production; hence sharp competition among millers. He considers that Russia and India are forestalling the United States, and that the wheat world was quite taken aback at the enormous quantity India has shown herself capable of supplying her surplus for 1885, excluding the reserves, being 1,300,000 tons. With this amount of grain thrown on the markets of the world, prices must continue to fall, and those producers who cannot compete with India in profitable production must go to the wall. The English farmers must inevitably do so unless they change their line of products. With regard to flour he thinks English millers can hold their own, for though much of the India wheat is doubtless dirty, English ingenuity is equal to the handling of it, and their millers make excellent flour out of what appears to Californians very poor stock. All India wheat, moreover, is not to be classed as of inferior quality, No. 1 Bombay wheat being equal to the finest wheat produced in California.—*Herapath's Railway Journal.*

Indigo prospects in Lower Bengal are by no means satisfactory, as the produce has not improved, and accounts from Krisnaghur and Jessore are worse, while those factories which chiefly depend on spring sowings are sure to make a very small outturn. In fact, it is doubtful whether the total outturn from Bengal will be equal to that of last season. The

accounts from Bhagulpur and Purnia are, however, more favourable, and the outturn will probably exceed that of last year. Very heavy rain has fallen throughout Behar, but the reports from Champarun continue very good, and there has been a slight improvement generally in Tirhut. But the prospects in Chupra are only middling, and the season is very backward, so that no idea can as yet be formed of what the first cuttings are likely to amount to. There has been too much rain in a great part of the North-West Provinces and Doab, but while the reports from some districts are favourable, those from the others are quite the reverse, and, on the whole, the produce is not expected to exceed that of last season

The following shows the exports of wheat and maize, including wheat in flour, from all American ports and Montreal from September 1 to July 3, for the years named :

	Wheat. Bushels.	Maize. Bushels.
1885-6	78,031,000 ...	57,753,000
1884-5	104,813,000 ...	45,331,000
1883-4	88,515,000 ...	32,481,000
1882-3	115,724,000 ...	38,091,000
1881-2	101,724,000 ...	24,038,000
1880-1	141,857,000 ...	69,785,000
1879-80	151,375,000 ...	87,785,000

France.

The International Exhibition illustrative of the industrial arts and sciences has been opened at the Palace of Industry, and will continue for the period of four months. July having been upon the whole, very favourable to the crops, the backwardness so evident a month ago has almost entirely disappeared. It will be some time yet before an accurate estimate can be formed as to the wheat crop. The wheats of the centre are well spoken of, while those of the north, if no accident supervene, will excel even these. Rye is now entirely cut, and the crop, though very good, is a trifle inferior to last year's in quantity. Barely, now being harvested, promises most satisfactory results. Oats are an extremely abundant crop. The weekly meeting of the National Agricultural Society of France was attended only by a few *savants* of the old school and officials whom the tide of travel has not swept away from Paris. Agriculturists were entirely absent. The principal topic was the introduction of a new sugar into the field of competition, due to the researches of a German scientist.

Germany.

During the last week of July the weather in North Germany has been warm and dry. The barometer in the beginning rose and then fell suddenly. Rye harvest, which in many places began this week, has in consequence made progress, the straw yield is not very satisfactory, but the yield of corn on the other hand is very good. If the present weather continues, the good promises of the potato and turnip-fields will be fulfilled. The prospects of other crops are generally very favourable; the recent rains have refreshed and improved the second hay and clover crops, which will, it is to be hoped, help to make good the losses of the first crop. In order to encourage the culture of willows; the Government President of Frankfort-on-der-Oder has been requested by the Minister for trade and Industry to procure information as to the number of basketmakers, and the number of hands and apprentices employed by them; also as to the quantity of material used by them, and where they procure it. A basket-weaving school, to be built on the estate. Kriescht, has been proposed as one means of improving this branch of industry. It will be built by the Govrnment.

United States.

From over 4,000 crop reports from all parts of the country, the *Rural New Yorker* concludes that the winter wheat crop is on the whole good, the probable yield being 295,000,000 bushels, against 212,000,000 in 1885, with slight increase in acreage. Spring wheat has been considerably injured by drought and blight. The yield will probably be 140,000,000 bushels, against 145,000,000 last year. The total wheat crop will probably be 435,000,000 bushels, against 357,000,000 bushels last year. In oats there has been a slight increase in acreage, and the crop will probably yield 600,000,000 bushels, against 629,000,000 bushels in 1885. Of rye and barley there will be an excellent crop. There is a good stand of corn, and the outlook is excellent for a fine crop. Of early potatoes the crop will be heavy. Late potatoes are promising. There has been a large increase in the area of cultivated grasses in the west and south, and considerable in clover. There will be a heavy crop of hay. There is a slight increase in the area of tobacco, and a decrease in the acreage under hops. The slight decrease in the area under cotton in the older States is more than counterbalanced in the new. The condition is lower than in 1885 outside of New England. Apples are likely to be only a fair crop. The pear crop will be poor, and the peach crop below the average. On the whole, there is an excellent harvest outlook. From more than 5,000 reports from special correspondents the *American Rural Home* summarises the crops of the country as follows :—The unprecedented heat, accompanied with dry weather ever since last July, is telling very severely on meadows and pastures. Spring wheat, oats, and grass crops are all more or less injured by the extremes of weather during the growing season. The winter wheat harvest is over, with the exception of that of Michigan, which is rapidly being finished. North of the Ohio river the crop is secured, generally in good condition. Stacking and threshing are progressing, and an early movement is looked for. It is very fine weather for securing the crop. The yield is about the same as the crop of 1885, which was generally below an average. Oats are very irregular in stand; early sown are headed out and turning good; late sown are indifferent in length and stand poor. The decrease in the spring wheat yield is variously estimated, all the way from 25 to 40 per cent, according to locality. Corn is holding its own well, but must have rain within the next ten days to insure a full crop.

PASTEUR AND HIS WORK. FROM AN AGRICULTURAL AND VETERINARY POINT OF VIEW.

By George Fleming, L. L. D, F. R C. V. S.,
Principal Veterinary Surgeon of the Army.

(Continued from the last number)

"In the destruction of that which has lived," says M. Valery Radot, in his 'Life of Pasteur,' "all reduces itself to the simultaneous action of these three great natural phenomena—fermentation, putrefaction, and slow combustion. A living organism dies—animal or plant, or the remains of one or the other. It is exposed to the contact of the air. To the life which has quitted it, succeeds life under other forms. In the superficial parts, which the air can reach, the germs of the infinitely small ærobies hatch and multiply themselves. The carbon, the hydrogen, and the nitrogen of the organic matters are transformed by the oxygen of the air, and under the influence of the life of these ærobies, into carbonic acid, vapour of water, and ammonia-gas. As long as organic matter and air are present, these combustions will continue. While these superficial combustions are going on, fermentation and putrefaction are doing their work in the interior of the mass, by the developed germs of the anærobies, which not only do not require oxygen for their life, but which oxygen actually kills. Little by little, at length, by this work of fermentation and slow combustion, the phenomenon is accomplished. Whether in the free atmosphere, or under the earth, which is always more or less impregnanted with air—all animal and vegetable matters end by disappearing. To arrest these phenomena, an extremely low temperature is required. It is thus that, in the ice of the Polar regions, antediluvian elephants have been found perfectly intact. The microscopic organisms could not live in so cold a temperature. These facts still further strengthen all the new ideas as to the important part performed by these infinitely small organisms, which are, in fact, the masters of the world. If we could suppress their work, which is always going on, the surface of the globe, encumbered with organic matters, would soon become uninhabitable."

In the results of his researches into the acetic fermentation, Pasteur has not only again shown the uncertainty of mere observation as compared with the reliability of experimentation, especially when such a master institutes decisive experiments that are in conformity with and explain facts, but he has conferred a great benefit upon industries closely allied with agriculture, and has more or less directly benefited agriculture itself. And in these researches he has once more upset the theories of such chemists as Berzelius, Mitscherlich, Liebig, and others and placed our knowledge of an important industrial process,—the production of acetic acid—on a safe and solid basis, by proving that this depends upon the fixation of atomospheric oxygen by a micro-organism.

The manufacture of vinegar is largely carried on at Orleans, being one of the staple industries of the city, and to this Pasteur devoted his attention When wine becomes sour—as in bottles to which through faulty corking, air has obtained access—it is noticed that the oxygen which was originally in it has disappeared and that nitrogen has replaced it; while the alcohol has also vanished, and in its stead is acetic acid or vinegar. The presence of air is necessary for this change, and before Pasteur took up the subject, the ordinary method of manufacturing vinegar was to expose barrels half-ful of vinous fluid to the air, and at a certain temperature; the acetic fermentation was set up and carried on, and every week a small quantity of vinegar was drawn from the barrel and an equal amount of new wine added. This was a slow and a somewhat unsatisfactory process, inasmuch as some months elapsed before fermentation was fully established. The notion was that the alcohol in the fermenting wine was changed into vinegar, by the chemical influence o the oxygen in the air, acting in the presence of dead albuminoid matter. But Pasteur proved that this matter had no influence on the change; for though alcohol be mixed with pure water until it is reduced to the strength of wine, and exposed to the air, it will show no trace of vinegar; yet if some wine be put in a bottle, and this be sealed and then heated to about 140° Fahr., the same result will be noted; while if it be not heated it will become sour. More than this, if the bottle which has been subjected to the high temperature, be afterwards opened and the air admitted, the wine sours. In addition to this demonstration, and to still further show that the dead albuminoid mattor of the chemists had nothing to do with the conversion of alcohol into acetic acid, Pasteur removed all traces of albuminous substance from wine, and introduced to it a small quantity of phosphates of ammonia, potash, and magnesia; the vessel was then sealed up and laid by for some time. When again examined, the alcohol had become vinegar.

The real cause of the change was the presence of a minute fungus—the *Mycoderma aceti*—known for generations as the "flower of vinegar," which is always seen on the surface of wine undergoing the change, but which Liebig, who knew it, considered a mere coincidence. The formation of vinegar is always preceded by the development, on the

surface of the wine, of this very minute plant, which, when magnified, appears as an extremely fine constricted body; its accumulation constitutes sometimes a scarcely perceptible scum, at other times a thin wrinkled film, unctuous to the touch, because of the various fatty matters it contains. It has the singular property of condensing considerable quantities of oxygen, and of fixing this gas upon the alcohol, thereby transforming it into acetic acid. But like the larger members of the vegetable kingdom, it must have its appropriate aliment, and wine offers this in abundance, in the form of nitrogenous matters and phosphates of magnesia and potash.

To make vinegar from wine, all that is needed is to mix it with one-fourth of its volume of vinegar, and sow on its surface a few seeds of the fungus, which is done by transferring a little of the mycodermic film from a liquid covered with it. If it be summer, or if the room be heated (for it thrives best in the warmth), in at most forty-eight hours, the whole liquid is covered by it, and after some days the alcohol has become acetic acid. Pasteur, wishing to give an idea of the prodigious activity and prolificacy of the little organism, stated during a discussion at the Academy of Sciences, that he would undertake in twenty-four hours to cover with it a surface of vinous liquid as large as the hall in which they were assembled having the previous day sown in it the almost invisible particles of newly-formed *Mycoderma aceti*. Millions upon millions of the organism spring into existence in twenty four hours. Nothing is more simple than to obtain it in the first instance, it being one of those so called "spontaneous" productions which are almost certain to appear on liquids or infusions which contain its necessary food. It is present in the air of towns and buildings, and in wine, vinegar, and other fluids; and if it is desired to procure some of the mycoderma, it is only necessary to place a mixture of wine and vinegar in a warm place, when in a few days there will appear little greyish patches on the surface, which go on increasing progressively and rapidly. This is the Mycoderma grown from the seeds, or "germs" which the wine or vinegar accidentally contained, or which the air carried,—just as weeds grow in fields from seeds which are brought there by the wind or animals. That the latter may be also instrumental in extending the process of acetic fermentation is beyond doubt, for in vinegar manufactories, and in places where vegetable matter is souring, there are usually seen numbers of little reddish flies which come from we know not where but which, by means of their feet or proboscces, convey the seeds of this cryptogam.

When a bottle containing wine is subjected to a temperature of 120° to 140° Fahr., the wine remains sweet, because the Mycoderma germs in it and in the air in the bottle, are killed by the heat; but if the bottle be opened, the wine will sour, because new germs gain access. Wine in well-filled bottles, laid flat, does not become acid, because the Mycoderma cannot grow without a sufficient supply of oxygen; for although air penetrates the pores of the cork, yet it is in such minute quantity that the oxidisable constituents of the wine absorb it, without leaving any for the bottle. But when the bottles are placed upright, the corks become dry, and the air more readily passes through them: so that the germs on the surface of the wine are surrounded by air, multiply, and break up the alcohol into acetic acid.

The Orleans method of manufacturing vinegar. Pasteur determined to improve, according to the discoveries he had made in acetic fermentation. The disadvantages attending the system hitherto were very serious, and have been briefly alluded to. Into large barrels is first introduced a quantity of good vinegar, with about a fiftieth part of wine. Eight days after, some wine is added, and in a week another quantity, until the barrel is half filled. Then vinegar is drawn off to a certain amount, and fresh wine added to replace it, this process being repeated every eight days, the maximum quantity of vinegar obtained every week from one of this casks, or "mothers," as they are called, being a little more than two gallons; but when the casks work badly, which is frequent, this quantity is diminished. It requires three or four months to prepare a "mother," which has to be very regularly fed with fresh wine, or all will be spoiled, and the business must be commenced anew; the manufacture has to go on at all times, whether vinegar be required or not; and the barrels cannot be stirred from their places during the process.

Instead of the "mothers," Pasteur recommended vats placed in a chamber heated to about 76° Fahr., and filled with vinegar and wine, on the surface of which the Mycoderma was sown. This simple process, founded on the exact knowledge of the cause of acetic fermentation, has been eminently successful. A large manufacturer of Orleans stated, that at the end of a week or ten days, all the acetified wine is converted into vinegar, and that from a hundred litres of the former he drew off ninety-five of the latter. After the great rise of the temperature noticed when the vinegar is being formed—due to the combination of the oxygen with the alcohol, that fluid is allowed to cool, is drawn from the vat, barrelled, refined, and is ready for use. The vat

being emptied, is cleaned, again charged, the acetified wine sown with the plant, and the same process gone through.

CALCUTTA MARKET REPORT.

FOR THE WEEK ENDING 6TH AUGUST 1886.

Tea.—Public sales were held yesterday at which 14970 packages were offered and 14560 disposed of. Broken Pekoes without special point were a shade easier, whilst there was a strong enquiry for Souchong kinds and Broken Teas at slightly higher rates.

At the London auctions this week 8,000 packages of Indian Tea were offered, and 7100 sold. Common qualities were in good demand.

Wheat.—During the past week about 5,000 tons have been sold at advancing prices, say, Rs. 2-10 for Cawnpore, and Rs. 2-9-6 for Sibgunge quality.

Linseed.—The transactions reported aggregate about 1,200 tons. The market is very firm at Rs. 4-10 for small grain 5 per cent. refraction, and Rs. 4-8 for 10 per cent. refraction.

Poppyseed.—About 1,000 tons have found buyers at Rs. 3-13-6.

Jute.—A moderate business is reported to have been done at unchanged prices, but there is less enquiry at the close, the Home market being quiet with a downward tendency.

FOR THE WEEK ENDING 13TH AUGUST.

Tea.—At the public sales held yesterday 11, 750 packages were offered and disposed of. There was considerably more animation in the biddings, and the market may be quoted nearly 1*s* 2*d*. per lb. higher for Souchong kinds and Broken Teas, while, Pekoes and Broken Pekoes advanced from 1-2 per lb. on the lower to 1d. on the higher grades.

At the London auction this week 17, 000 packages were offered and 15,800 sold. There was a good demand for all descriptions.

Wheat.—There has been less demand for this staple, and the sales reported during the week do not amount to more than 1, 500 tons. Prices are rather lower, Club No. 1 being quoted to-day at Rs. 2-11-6 and No. 2 at Rs. 2-9-6.

Linseed.—About 4,000 tons have changed hands during the week at advancing prices, but that market close with a quieter feeling. The quotation to-day for small grain, 5 per cent. refraction, is Rs. 4-11-3.

Rapeseed has attracted no attention.

Jute.—Business in baled has continued to be on a limited scale, shippers being unable to work at prices generally asked by sellers. Quotations are about Rs. 22 for Saugor Dutt's double triangle M, and Rs. 20 for ordinary native first marks. Loose Jute is reported to be in good demand for the local mills.

FOR THE WEEK ENDING 28TH AUGUST.

Tea.—Public sales were held yesterday at which 10,500 packages were offered and 10,100 disposed of. The quality was generally good, and all descriptions were fairly competed for, the better grades of Pekoe Souchong being in most request.

At the London auctions this week 17,000 packages were offered and 14,800 sold. There was a good demand for all descriptions at full rates.

Wheat.—The market has been rather easier and about 5,000 tons of Club No. 2 have been sold at Rs. 2-10-6.

Linseed.—About 2,500 tons have changed hands at somewhat lower rates. Small grain, 5 per cent. refraction, is quoted to-day at Rs. 4-10-3. Further transactions to the extent of about 4,000 tons have taken place in next year's crop at Rs. 4-6 for small grain, 5 per cent. refraction, April-May delivery.

Poppyseed has been in moderate request at Rs. 3-11.

Jute.—A fair business has been put through in baled Jute at rather better rates, but at the close the feeling is quieter again. Quotations are about Rs. 22 for Saugor Dutt's double triangle M and about Rs. 21 for ordinary native first marks.

CROP AND WEATHER REPORTS.

For the week ending 28th July, 1886.

General Remarks.—With the exception of the western districts of the Punjab, rain is reported from nearly all parts of India. In the Madras Presidency the falls have generally been light.

In Madras, Mysore, and Coorg the standing crops are doing well, and prospects are good.

The kharif sowings have been almost completed in Bombay and the North-Western Provinces and Oudh, and are still in progress in Hyderabad and Rajputana. A break in the rains would be beneficial in some places. In the Punjab rain is still much wanted in the Peshwar district, otherwise prospects continue fair.

In the Central Provinces prospects are generally good, though more rain is wanted in the Chhattisgarh Division.

Transplanting is well forward in Bengal, except in the western parts of the Province, where more rain is wanted. All autumn crops and sugarcane are promising well, and the early rice and jute harvests have commenced in some districts with prospects of a good outturn. In Assam crops where uninjured by floods are doing well.

Ploughing and sowing for the rice harvest continue in British Burma.

The public health is generally fair.

Prices are falling in the Hissar, Jullundur, and Shapur districts of the Punjab, and are fluctuating in the Delhi and Mooltan districts; elsewhere they remain steady.

For the week ending 4th August, 1886.

General Remarks.—Rain is again reported from nearly all parts of the country during the week under notice. In the North-western Provinces and Oudh, and in some parts of Bengal, Assam, and Burma, the falls have been heavy.

The standing crops continue in good condition in Madras Mysore, and Coorg, and the prospects of the season are favourable.

Kharif sowings have been completed in most parts of Bombay, the North-Western Provinces and Oudh, the Central Provinces, and Berar. The young crops promise generally well.

In the Punjab prospects are genrally good, though in the Peshwar district rain is still badly wanted. In Rajputana and Central India prospects are on the whole very favourable.

In Bengal the season promises very well. Transplanting operations are in active progress, and the early rice and jute crops are being harvested, with prospects of a good outturn. Reaping and transplanting operations are making good progress in Assam.

In British Burma the land is being ploughed for the rice crop in all districts

The public health continues fair in all Provinces.

Prices are steady, except in the Dera Ismail Khan districts of the Punjab, where they are rising, in the Hissar and Shapore districts of that Province and in Mysore, where they are falling, and in the Delhi and Mooltan districts of the Punjab, where they are fluctuating.

For the week ending 11th August, 1886.

General Remarks.—There has been a break in the rains in some districts in the North-Western Provinces and Oudh, the Punjab, and the Central Provinces. In almost all other parts of the comntry rain has fallen. In parts of Bengal and Assam the falls have been heavy.

In Madras, Mysore, and Coorg the standing crops are in good condition, and prospects continue favourable.

Kharif sowings have been completed in nearly all districts of Bombay and the North-Western Provinces and Oudh, and the young plants are doing well. In Nimar and in the Nagpur and Chhattisgarh districts of the Central Provinces more rain is much wanted.

Prospects are generally good in the Punjab, but more rain is required in the Hissar, Shapur, Rawalpindi, and Peshwar districts.

In Rajputana and Central India States agricultural prospects continue satisfactory, but more rain is need in places.

Excessive rain has injured the crops in parts of, Bengal, but prosdects, on the whole, are still very favourable.

Ploughing and sowing and transplanting are in progress in Lower Burma.

In Assam heavy and incessant rain has caused some damage to crops in Sylhet.

The public health is generally fair.

Prices are on the whole steady.

For the week ending 18th *August,* 1886.

General Remarks.—On the whole, the rainfall of the week has been slight throughout Upper India. Heavier falls have occured in Burma, Assam, Eastern Bengal, and the peninsular area generally.

In Madras, Mysore, and Coorg prospects continue satisfactory.

In the Bombay Presidency and in the North-Western Provinces and Oudh, the kharif sowings have been almost completed, and the young crops promise well. Prospects are generally favourable in the Central Provinces. though more rain is badly wanted in parts of the Chhittisgarh Division.

In the Punjab, Rajputana, and Central India prospects are generally good, though more rain is wanted.

In Berar the crops are doing well.

In Bengal the break in the rains has been advantageous to the crops, which are very promising, except where injured by floods. The aus rice and jute harvests are progressing, with fair outturns.

In Cachar and Sylhet much damage has been caused to the crops by the floods, and prospects in these two districts are generally unsatisfactory.

In British Burma sowing and transplanting for the rice crop continue.

The public health continues fair.

Prices are falling in the Mysore and Coorg and in the Hissar and Mooltan districts of the Punjab, rising in the Forozepore, Rawalpindi, and Peshwar districts, and fluctuating in the Delhi district. Elsewhere they are generally steady

For the week ending 25th August, 1886.

Generl Remarks—Rain has been general, except in some districts of the Punjab. Heavy falls have occurred in parts of the Bombay Presidency, Rajputana, Assam, and Lower Burma.

Standing crops are in good condition, and prospects are satisfactory in Madras, Mysore, and Coorg.

More rain is wanted in parts of Bombay Presidency, but the standing kharif crops are everywhere doing well.

In the Punjab and North-Western Provinces and Oudh prospects are good, though more rain is wanted in some places

With the exception of the Chattishgarh division, where good rain is urgently needed, crops are thriving throughout the Central Provinces.

In the Rajputana and Central India states and in Berar prospects are good.

In the Lower Provinces prospects continue very favourable. except in the flooded tracts in North Behar and East Bengal. More rain is, however, wanted in places. Harvesting of early rice and jute is progressing, with promise of a fair outturn.

In Assam prospects are unchanged in Sylhet. In Cachar the floods are subsiding slowly.

In Lower Burma ploughing, sowing, and transplanting are still in progress.

The public health continues generally satisfactory.

Prices are rising in the Mooltan, Rawalpindi, and Peshwar districts of the Punjab, and in the Bilaspur district of the Central Provinces, In the Mysore district they are also rising, but are falling in Kolar and Tumkur. Elsewhere they are steady,

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Cawnpore Experimental Station.—For the kharif season 1885, the rainfall was of unequal distribution, being heavy just at the very ploughing and sowing time, while at the end it ceased altogether. Sorgho and maize suffered, but cotton appears to have done fairly well. Notwithstanding the eccentricities of the season, the established precedence of the various manures was fairly maintained; but the yield of both grain and straw was remarkably low all through and would appear to indicate that ordinary cultivators must have suffered considerably. That they did so was very practically established later on by the scarcity amounting to very grave inconvenience throughout the country of that winter fodder which in ordinary years is derived from the stalks and straw of kharif crops. In the comparative experiment plots, saltpetre maintained the lead. The most interesting fact in connection with manuring experiments is the high value now obtained from woollen refuse, a waste product of the Cawnpore Mills, which the latter at one time found the greatest difficulty in getting rid of on any terms. After saltpetre, woollen refuse has given the best results and has again proved to be better than poudrette for maize. By the results of the past two years, the conclusion can safely be drawn now that it is a good manure. If the blanket-manufacturing class in the country, who as a rule are cultivators too, become aware of the fact and learn it that they can utilize the waste of their manufactory in fertilizing their fields, they can derive immense good by it. They already know the effect of their sheep excrement, but do not know the value of the woollen refuse, which simply wasted. Brick-kiln refuse too is has proved to have manurial value in it. Its quality, of course, would depend on the nature of fuel burnt in it. Ashes of cow-dung have also always proved to act as fertilizer, but of course they are not so good as the unburnt dung. Saltpetre in every case has shown its good effect. The figures for pigs' droppings and for poudrette embody facts interesting to students of rural sanitation.

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The sowing of maize after the American method was personally conducted by an American gentleman at whose suggestions the experiment was carried out, but the results were not satisfactory; and, as the season was so unfavourable, it is hoped that next year may show better. Used as the test crop in trial of deep *versus* shallow ploughing, the deep-ploughed plot of cotton as usual gave the best results. Tested for various methods of sowing, that of broadcast sowing proved most suitable for the slender plants of country cotton, while for the more bushy occidental varieties, sowing in lines is better adapted. Cow-dung manure nearly doubled the produce as compared with that on unmanured plots. Eight different varieties were grown for comparison, with the result that Saharanpur seed gave the best results, ordinary country cotton and New Orleans following with about equal success. Some very useful experiments were instituted last year under this heading in view of ascertaining the comparative outturn in the system of growing oilseeds alone and mixed. A connected series will in due time furnish

figures now greatly needed for the annual harvest forecasts for the provinces.

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Another useful series termed in the report "miscellaneous" was inaugurated to test the value of the method largely followed of sowing mixed crops in the kharif, one of which is reaped with the rabi harvest and the other with the kharif season harvest, instead of sowing a full kharif crop one year and a full rabi the next. The results as they stand are summarized thus:—Black til sown by itself gave larger yield than the crops of til and juar put together, which were grown in one field: so the juar sown separately has thrived better. This result leads to the idea that the native fashion of sowing til wiih other crops is no good. But this may not be considered a criterion as being the first trial. Til with bajri did not grow at all. This is due to bad season of course, but bajri sown separately has done better than sown with til, though the til did not yield anything. The early variety of white til totally failed to give any crop. Late variety of white til gave better crop than black til and has also thrived with maize well. The series will be continued until sufficient figures have been collected to admit of true deductions being drawn. The ryots do not grow their crops for experiment. They follow the shift of growing mixed, crop for by experience they have found out that in case the season turn out to be unfavourable, they can fall back upon one crop, even if the other fails.

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A small experiment was tried in growing sugarcane according to the Mauritius method as compared to that in vogue in the district. So far as the experiments went, the Mauritius method proved no more superior to the local methods than did the Demarara plan tried on the farm about two years ago. Ensilage system can no longer be considered in the light of an experiment, as it has been successful on the Station for some three years past and silos form a regular part of the establishment. The inopportune rains and consequent failure of kharif fodder proved this year the opportunity of ensilage. In the previous year a great deal more fodder had been ensilaged than could at the time be got rid of, and it was reserved as an experiment against time. When opened after 18 months, it was found so good that the farm cattle were fed almost exclusively on the ensilaged juar for about two months, keeping excellent condition The result was a large saving in money which would otherwise have had to be expended in buying fodder at the very high rates ruling. Grass was not so successful as juar. It is to be noted that the offensive smell so often complained of in regard to silos is not a concomitant of those at Cawnpore.

* * *

Under implements the centrifugal sugar separator introduced by the makers of the Behea mill promises to be a most useful addition to implements suited to the country. In regard to Rogers' sugar mill, it is true that the weight renders it less portable than mills with wooden stands: but, on the other hand, weight lends stability, an object most desirable to attain in working any mill. Bull's improved dredger has proved a decided success. Four are now in use and orders have been received for six more, which are now on their way from ombay. It greatly cheapens and expedites well-sinking when sand is met with. Mir Muhammad Husain M. R. A. C. was in entire charge of the farm for the period under report and had much difficulty to contend with in the character of the season.

'Agricultural Education"—In an article on this subject the *New York Tribune* says:—The professors in our various agricultural and industrial colleges recently held a conference at Purdue University, Indiana, at which the important problems in technical education were discussed. The most serious question of all, however, seemed to be the fundamental one "How can we get any students of agriculture to educate ?" In the admirably equipped Illinois University, the agricultural department has had at times but two or three students, and the same is true of Ohio. At Purdue itself there are no over shadowing literary or professional departments which are believed by some critics to smother and repress the industrial branches when all are combined in a single university. And yet in this college, strictly one of agriculture and mechanics, with 200 students on its rolls, only two members of the sophomore class and nine freshmen are taking the agricultural course. Wherever students have any latitude of choice between a course including agriculture, horticulture, and forestry on one hand, and science, mechanics, and art on the other, they largely select the latter. But the young men are not alone in their aversion to the systematic study of agriculture. The feeling seems to be shared by their parents. Farmers send their sons to the Land Grant colleges and express their preference for the course that omits agriculture. One reason for this is that many of them have no faith that any instruction can be

given in a college that "will be a direct and special help to agricultural practice. Others consider the rewards of agriculture so slender that they counsel their children to abandon the farm and enter one of the learned professions or adopt some more lucrative business. The young man shuns the farm because he is taught that it offers no fair field for the activity of a trained mind as well as because it offers no opportunities for quickly acquired wealth. He avoids the agricultural course in the college because he feels that it will give no vigorous excercise to his intellect. A stigma thus rests upon agricultural study as well as upon agricultural practice. In the student's view of the case, it takes a lower rank and is less honourable than other studies . . . The sum of the matter, then, is this. The country relies at last on its farmers. The farmer of the future must work with increasing knowledge of his business. The agricultural colleges stand prepared to furnish this training. The men who need it most fail to appreciate their need, or do not know that the colleges can supply it, or positively distrust and in some cases openly oppose them.

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THE CONSUMPTION OF COFFEE.—It will not surprise our readers to learn that the annual report just issued of the Commissioners of Inland Revenue shows that during recent years there has been a continuous decline in the consumption of coffee in England. In 1852 the amount per head was 1·207 lb., by 1862 it had fallen to 1·178 lb., ten years later it was ·976 lb., in 1882 it was ·885 lb., and although last year there was an increase, it stood only at ·898 lb. It is also worthy of note that the latest statistics issued show that there has been a decrease in the amount of coffee used by the American people, but with them it is the first shrinkage that has been visible for some years past. On this point our New York contemporary *Bradstreet's* observes that "while prices have been favourable for a large increase in the consumption, there has been a decided shrinkage from the previous year, as will be seen from the following table, which gives the official returns with the *per capita* consumption :—

	Pounds consumed.	Per captia.
1880	446,063,676	8·89
1881 ...	466,159,588	9·06
1882 ...	458,497,517	8·70
1883 ...	515,921,287	9·52
1884 ...	532,514,850	9·59
1885 ...	572,222,841	10·02
1886 ...	537,692,262	——

The consumption *per capita* will show a greater decrease than the total consumption; but as the estimated populaton is not to hand, it is imposible to give the correct figures, though it is pretty sure to show a decrease from the preceding three years. It is impossible at this moment to account for the decrease, as it may come from the substitution of other beverages, or from economy on the part of the consumers. From this is assumed that the diminution in the American use of coffee is casual, and not likely to be permanent. There is also the significant fact to be noticed, that whilst the consumption per head in England is under a pound, in the United States it is apparently between nine and ten pounds; and the general view of economists appears to be that America ranks first as a coffee-drinking country, and England last. When, however, grocers in England more generally begin to roast their own coffee, we may soon hear a different tale.—*The Grocer.*

* * *

KHANDESH EXPERIMENTAL FARM.—Our readers are perhaps aware that this is one of the biggest Government Farms in India, and this is the second report of the farm since it has been placed under the Agricultural Department of Bombay. The season of 1885 has been in many respects a very peculiar one owing to the irregularity of the rainfall which, although everywhere much below the average, nevertheless favoured certain patches with timely showers at sowing season, while others in the same locality were left perfectly dry until the season was too far advanced for profitable sowing. In fact each village seemed to have a kind of weather programme of its own. Although there were a few showers in June it was not before the second week in July that the ground was really moist enough for sowing. By that time however the best cotton season had gone and many people had in the meantime risked sowing in the dry—some to reap a fair crop, others disappointment—according as a shower did or did not fall within a few days after sowing. A long break in the second half of September sorely tried the imperfectly nourished young crops, but just as they began to show signs of real distress the heavy rains of September came, only in time to prevent a wide-spread failure. These remarks apply to the farm and neighboured.

* * *

The experimental part of the farm was for convenience increased during the year by $4\frac{1}{2}$ acres. Of the series of plots into which this part is divided, the most intersting the one styled *Lois weedon series.* In this series, as in the previous year, two plots were

set apart for continuous growth of wheat year after year, four plots for wheat under rotation, two plots for wheat grown on the *lois weeden system*, and two more plots for other rotation crops. Comparing the figures of the previous crops with that of the year under report, it appears that the weight per bushel of the two years' grain is almost the same, but that there is a vast difference in the quantity. The yield for 1884-85 was 800 lbs. per acre while that far the last year is only 540 lbs. On the other hand, the straw of the latter is actually in excess by 19 lbs. The difference is mostly due to season and also partly no doubt to waning fertility. The observable difference in the yield of grain in two rotation plots explains the Kunbi's anxiety to sow his wheat as early as possible without running too much risk of rain falling before the young *braird* is fairly above ground. Rain, they say, falling on the seed before germination increases the quantity of straw at the expense of grain. The accuracy of their observations in this respect is fully probed by the figures of the two wheat plots. One of these two plots was sown on the 4th of October, on evening of which very day, showers amounting to 2 92 inches unexpectedly commenced to fall. This delayed the sowing of the duplicate Plot to the 13th when the ground was again dry on the surface. The crop of the first plot kept the lead in appearance all through the growing season and at harvest produced 277 lbs. of straw against 264 lbs. of the second plot, which latter, however, showed the higher return of grain by over 300 lbs. per cent. The pair of plots which were cropped on the system from which the series takes its name were only half occupied, the ground being laid off the same as last year in parallel ribbons of 3½ feet wide alternately cropped and left vacant, the occupied strips corresponding with the vacant one of the previous year, while that which bore last crop was cultivated from time to time. The cost of cultivation is shown to be Rs. 2-4-0 for the two plots for the year or at the rate of Rs. 5-10-0 per acre. This outlay may correctly be considered as the *cost of fortilizer* for next year's crop. The average outturn of these intercultivated plots was 550 lbs. grain per acre and 805 lbs. of straw. The former being 65 lbs. lower and the latter 155 lbs. higher than the corresponding figures of the preceding year. This difference too, probably is owing to bad season, if not also to waning fertility.

* * *

The hard and soft wheats supplied by Messrs. Ralli Brothers for the purpose of comparative experiment were grown in the new extension. The prominent features of the results are (1) abnormal increase in the proportion of straw to grain, (2) general increase in the weight of grain per bushel, and (3) the tendency of the softs to become hard. The first as already explained is due to accident of season. The second is not so easily accounted for; probably the most satisfactory explanation is change of soil, which, as is well known, has a powerful effect in enhancing the quality of wheat. The third is apparently mere evidence of the process of acclimatization having already commenced. The teaching of the experiment then, so far as it goes, seems to be that the substitution in any district of one distinct character of wheat for another (such as a soft for a hard) is not easy of accomplishment, if indeed possible; also that occasional changes of seed if not too extreme, are particularly beneficial, especially in maintaining a high quantity of grain.

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The experiment in the picking of the seed for the prevention of smut or kani in jowari has been continued on a large scale. Sulphate of copper shows less effect than in the preceding year; common salt is about the same. The new pickle, *carbolic acid*, which is rapidly gaining the universal favour of European farmers, shows the best results, having only 8 bad ears in the one plot and 7 in the other. *Urine is lower still*, with on y two smutted ears in each plot. The cure however is worse than the disease as it killed more than two-thirds of the seed right off, and the crop was very thin in consequence. Two plots left *unpickled* for the sake of comparism produced 19 and 62 diseased ears respectively. It will thus be seen that there is a want of uniformity in the results obtained which necessitates a continuance of the experiment for some time longer. A few plots were sown with gram and linseed at verious rates of seeding to demonstrate for the benefit of students, apprentices, and others, the comparative results of thick and thin sowing and to show where the profitable medium comes in; also to help in estimating the value of the figures derived from the general area which in common with the plots is subject to all the peculiar influences of season in addition, however, to numerous risks against which the plots are protected. *Linseed* was sown at rates varying from 8 lbs. to 14 lbs. per acre, the last giving the highest yield, although 12 lbs. is the reognized rate of seeding. The irregularity in this case is probably due to the fungoid diseas "Bhandara" which sorely depreciated the linseed crop of the past season. Most cultivators place the damage as high as 8 annas in the rupee

and above figures tend to prove that such estimate is perhaps fairly correct. *Gram* was on the whole a fair crop and was also comparatively free from disease, so that the figures are much more regular than in the case of linseed. The usual rate of seeding gram among the cultivators is 40 lbs. per acre and this, it will be seen, gives the highest yield (760 lbs. per acre), decrease and augmentation alike resulting in a falling off of produce.

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Of the *manuring experiments* the most interesting as well as valuable are those which have been designed to test the comparative merits of cow-dung and its ashes. The Superintendent of the Farm makes the following remarks:—"The result was only slightly in favour of the former (fresh cow-dung), raising a suspicion that the ashes had acted the more rapidly, but would not be so lasting; the correctness of this presumption is fully proved by comparing outturn of the preceding crop of gram which was 1,120lbs. per acre on the fresh manured portion against only 1,095 lbs. on that treated with ashes with that of the bajri of the two plots this year. The sum of the results seems to be that the cultivator who applies 30 tons of fresh cow-dung to his land instead of its ashes gains thereby Rs. 4 worth of grain at the sacrifice of about Rs. 20 worth of fuel for his domestic hearth." Without joining issue with him on his remarks, let us see whether they are warranted by the recorded results. The two plots which in the previous season were one manured with *ashes* of 30 tons cow-dung per acre and the other with 30tons *fresh cow-dung* per acre gave 1,095 lbs. and 1,020 lbs. of gram respectively and the same two plots last season yielded without any further manure 1,015 lbs of grain with 7,530 lbs of straw, and 1,210 lbs of grain with 10,190 lbs of straw of bajri per acre respectively. This experiment so far as it goes proves that *fresh cow-dung* is a more effective manure than its *ashes* and its effect more lasting. Four new plots designed last season to more positively test the comparative merits of cow-dung and its ashes brought out the same results, to back out of which the Superintendent ferrets out a new argument against the use of *fresh cow-dung*. He says—"the cultivator who applies 30 tons of *fresh cow-dung* to his land instead of its ashes gains thereby Rs. 4 worth of grain at the sacrifice of about Rs. 20 worth of fuel for his domestic hearth." But until he gives the authority from which he estimates the value of "the sacrifice" at Rs. 20, we are not prepared to accept his dictum.

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The run of bad cotton seasons has driven cultivators to their wit's ends in deciding how best to deal with land on which cotton has so far failed as to leave it certain that not more than perhaps quarter of a full crop need be expected. The alternatives are late sown millet, always a doubtful shift, and *rabi*, which is never to be relied upon in ordinary lands when the rainfall is below 25 inches. The relative values of the three principal rabi crops for purposes of interculture with cotton may thus be summed up:—(1) *wheat* besides being a strong growing plant choking the cotton and being spoiled by it in return, is also very liable to damage during final picking of cotton and removal of the plant (2) *linseed* being particularly susceptible to damage from both shade and insufficient moisture is not altogether safe; (3) *gram* with its creeping habit and comparative indifference to shade will usually succeed fairly well under all sorts of conditions and is therefore the best for the purpose.

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The most interesting fact in connection with arboriculture is the evil effect supposed to be due to the shade of babul trees. The remarks of the Superintendent on this subject are quoted in full length. It was found that *linseed* suffers by far the most severely from shade, after that *wheat*, and lastly *gram*. The trees, Babul (Acacia Arabica). Tamarind (Tamarindus Indicus). Siris (Acacia speciosa). Mango (Mangifera Indica). Neem (Azadirachta Indica), are those usually found on field boundaries and roadsides, and are arranged in order of their destructiveness. While the first is by far the most mischievous, the last on the list is the least so, and therefore the only fit for roadside planting; where cultivated fields come in the way, the owners of such fields are greater sufferers from the effects of shade than is generally suspected. It is curious that "this sterilizing influence of babul shade seems to be most active when the sun is only slightly above the horizon, or, as cultivating people express it, at 8 in the morning and 4 in the afternoon. Thus a tree in the middle of crop destroys two traingular patches, one of the north-west, the other to the south-east, the height of each trangle from base to apex being usually equal to about twice the height of the tree. The average of a number of measurements made with 35 feet trees worth Rs. 2 each exhibits a destruction of 240 square yards or 2 gunthas of crop, which, at the moderate estimate of 8 annas per guntha, shows that the tree, so to speak, eats off its head once every two rabi crops or once in four years. It is for this reason that the large babuls are generally to be seen with their branches hacked off close to the trunk. It was expected that last year the receipts of the Farm will cover

the expenditure but the expectation was not realized, there being a deficit of Rs 2,754-5-0.

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HYDERABAD EXPERIENTAL FARM.—The kharif season during the year under report was on the whole a good one for this part of Sind. It is no doubt to the scanty rainfall that the immunity from insect pests and fungoid diseases of the kharif crops is chiefly due. The innundation was a favourable one. The rabi season promised to be a good one, but the frost in the beginning of February did a good deal of damage to oil-seed, pea and cereal crops. The early plots, especially suffered from this cause.

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GENERAL AREA.—*Lucerne.*—The seed germinated very fairly and though it did not make very fast progress during the cold weather, the first-sown plot was ready to cut by the 12th December, on which date 173 lbs. were cut and a supply weighing more or less has been cut daily since. For more than a month past the value of the daily sale of lucerne from this field has been a little over Rs. 5, besides a plot measuring 17¾ gunthas, which has been harvested for seed, and 2¼ gunthas of the Poona variety, which is not yet quite ripe. Besids the above, 20 lbs daily have been fed to the farm cattle since the 8th of March. During the month of March the lucerne grew very fast; every 12 days a cutting could have been got from the same plot. Since the 14th of April it has been suffering more or less from the attacks of green fly and other insect pests, but as yet the heat does not seem to have had any bad effect on it. The treatment has been to weed out the perennial grass as much as possible, top-dress with well decomposed village sweepings after each cutting and irrigate sufficiently often to keep the soil moist. It is a costly crop to grow, if there be no great demand for it, but where there is a ready sale, few crop pay better.

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Sind Cotton.—Field one (No. 5) was sown previous year and half the area (3 acres) of the old stool's was allowed to grow last year at the Collector's desire. The result shows that the second year's cotton crop would pay the ordinary cultivator well, if the first year's crop is well manured. The seed cotton from three was ginned together and gave the following percentage:—Clean staple 36-13, seed 61-62, loss in switching and sunning 2-25; total 100,00. The whole of this cotton was ginned by the saw-gin (with the improved grid) received from the Bhadgaon Farm. It was driven by a 6 horse-power engine. In this way the cost for ginning amounted to Rs. 1-3-1 per maund (84 lbs) of clean cotton, as compared with Rs. 2½ to Rs. 2¾ for the native hand *charka.* The cotton sold for Rs. 15 per maund, while the ordinary native at the same time was selling for Rs. 13-8. The seed could have been sold for Rs. 1-10-0 per maund, but the price of the clean cotton alone was more than would have been got for both cotton and seed had it been sold unginned. The merchant who bought it said it would class in Karachi as Dera Multan. In comparison with the *charka* the percentage of clean cotton is greater nor is the seed broken. With the native gin it is not possible to avoid crushing immature seeds. "As soon as the gin was got into working order and we could feed without stoppages, we managed to gin two maunds of seed cotton per hour and keep this rate up throughout the day of nine hours. At the start off it took us 34 minutes to gin one maund, and to do this sharp steady handling was required."

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VERNACULAR AGRICULTURAL CLASS.—The boys attending this class numbered 13 (7 from Hyderabad and 6 from Shikarpur). At the final examination held at Hyderabad Normal School, 6 passed in all subjects, and 1 in the first year's course. Six left the class within a month of joining. The reason alleged was that the out-door work is too heavy. They cannot be said to have tried much, seeming lazy or else ashamed to handle the tools. At present there are 9 boys in the first year's class and 1 in the second. There have been more applications for admission from Hyderabad District than could be granted, but few care to come in from the Shikarpur District. All the boys have been attentive to their duties and well conducted. This is a distinctive feature of the Farm, not being in any other Government Farm.

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In the garden area the following fruit trees are being grown by way of experiment? *viz*, grape-vines, guavas, figs, plums and peaches, apples, pomegranates, pomeloes and oranges. Last year the whole of the garden fruit was sold by public auction and brought in Rs. 3,000. It was the vine that people cared to give money for, the other friuts they did not value at much. Looking at the balance sheet of the Farm we see that there was a loss of Rs. 2143-10.

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BEE KEEPING.—The following is from a correspondent of the Scottish Agricultural Gazette. The yield of honey depends altogether on management, locality, and the weather. If any of these are awanting then bee-keeping will not pay. If all three are present, then a large yield may be expected. 200 lbs. is quite a common weight for a hive to yield, and some have given far more. A clergy-

man in Cumberland last year had 114½ lbs. of clover honey from each hive, and a large harvest of heather honey to boot. I am not in a good locality, but I had upwards of a hundredweight from each hive, and some years I have taken 160 lbs. from one hive at a lift. But taking everything into consideration, it is not far off the mark to strike the average weight of honey from each hive at from 50 lbs. to 75 lbs. in the season; but that depends entirely on the season. If we had the same sort of weather we had when the days were longer and the sun shone longer and brighter, when the moon was seen to advantage for weeks together, and "the calm, dewy mornings" were not a rare occurence, but for weeks together with a serene sky overhead, with nature arrayed in robes of glory, then we might calculate upon taking from a hive of bees in the season several hundreds of lbs. The flora of Great Britain is sufficient to produce honey profitable at 1d. per lb., if we could only get genial weather in the proper season. The unsettled state of our atmosphere precludes bees from gathering excessive and us from arriving at anything like an accurate and reliable statement of what a hive of bees can do one year with another. I am quite satisfied, however, that bees kept as they should be will not only elevate the bee-keeper in a moral sense, but will repay him both pecuniarily and satisfactorily, as well as giving a degree of interest and pleasure not to be found in any other pursuit, rural or urban.

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EXTRACTION OF ALCOHOL FROM PRICKLY PEAR.—A paper was lately read before the Society of Natural and Physical Science at Malaga, by one of the Members, Don Fernando de la Camara, on the cultivation of "Cambos" (prickly pear, *cactus opuntia*), and the employment of the fruit for the manufacture of alcohol. The author states that his experiments, which have extended over a period of twelve years, afford most satisfactory results, and he suggests that the cultivation of this plant might advantageously take place, in this district on the land hitherto used for vineyards, which may have been destroyed by phylloxera, or on land which could not otherwise be profitably cultivated. The subject-matter of the paper is divid d under three headings— (1) The cultivation of the plants. (2) The process of fermentation. (3) The establishment and cost of the machinery and utensils necessary for the manufacture of the spirit, all of which are minutely treated of. Under the first part are described (*a*) the nature of the soil proper for the growth of the plant; (*b*) the atmospheric temperature under which it thrives which should not fall below zero, centigrade, and (*c*) the practical results obtained by the author in various Districts of his Province; from which it appears that a row of plants of ten metres in length, and two metres in width, produces, at maturity at Malaga, according to the situation, &c., from 2,000 to 4,520 pears or figs, annually, or, say, affords an average crop of 2,600 figs per ten metres. These results were obtained in rocky uncultivated ground, while much better crops are apparently obtinable under careful cultivation. The weight of the figs is stated to be about 13 to the kilogramme. From the experiments made for extracting the juice of the fruit it would appear that in the solution of 40 to 45 per cent., the odour and peculiar characteristics are perceptible, but a liquor is obtained which, it is thought, might be available for drinking purposes as Aniseed brandy. During rectification these properties tend to disappear, and in solutions of 70 to 75 per cent. the odour is much less apparent, while very little remains at 84 per cent. The average quantity of alcohol obtainable from the liquid is alleged to be eight per cent. Minute calculations are contained in the paper, as well as regards the cost of cultivation as of the expenses of manufacture, which the author states are the result of long and careful experiments on the subject; and the following totals of the figures given in detail for 200 hectares of land will serve to shew the profitable nature, as alleged, of this industry—Cost of cultivation, including—

	Rs.
Value of land	1,20,000
Cost of machinery, &c.	3,20,000
Annual expenses, including interest and taxes	1,04,000
Annual working expenses ...	1,24,000
Fuel	54,400
Harvest expenses	85,000
Carriage	85,000
Labourage	84,000
Total ...	4,33,200
Value of product	8,40,000
Rs. 100 = £1 Net Profit ...	4,06,800

Prickly pear plant grows abundantly in India, but we have never seen it fruiting.

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ELECTRIC AGRICULTURE IN GERMANY.—An interesting experiment, showing the influence of electricity on the growth of roots, has been made in Germany by Professor Holdefleiss. Plates of copper were thrust upright into the earth and connected by wires with similarly placed zinc plates about 100 feet distant—an electric battery being thus formed,

with the earth between the copper and zinc in the circuit. Both potatoes and beets planted between such plates gave an increased yield—beets 15 per cent., potatoes 25 per cent.—as compared with other parts of the same field.

CIRENCESTER COLLEGE. —At the final examination held in August last, Mr. Nityagopal Mookerjee, one of the two agricultural scholars for 1884 stood at the top of the list of successful candidates with a total of 1975 out of the possible total of 2100 the highest ever scored by any student since the foundation of the college. Before Mr. Mukherjee, Mr, A. C. Sen, now of the Bengal Agricultural Department, had scored the highest number of recorded marks and Mr. Mukherjee has surpassed him. These instances speak volumes in favour of the diligence and earnest work of the Bengal Agricultural Scholars, against whom rumours of desultory reading while in England were lately spread in certain quarters. In virtue of his securing the first place, Mr. Mukherjee has won the "Gold Medal," which hitherto for technical reasons or otherwise had not fallen to the lot of any agricultural Scholar from Bengal. Mr. D. N. Roy, the the other agricultural scholar, has also passed out. Both of them are soon expected back to Calcutta. We hope they will fare better than their predecessors.

AGRICULTURAL REFORMS IN KATTYAWAR.

This subject has drawn the attention of a few of the Native States in Kattyawar, where lately some sort of regular Agricultural Departments have been established. The British Political Officers there, seem sometimes to take lively interest in it. One of them Col. Nutt, who has great taste for it, held Agricultural Shows, lately at Wadhwan and one at Gondal, both of which were a great success. Such kind, of Agricultural Shows if held occasionaly at different places, will, no doubt, do much good in the improvement of Agriculture.

Gondal State in Kattyawar has lately opened an Experimental Farm, in addition to the Botanical Gardens there, to try experiments on various crops, indigenous as well as foreign, manures &c. Ensilage system is also being tried this year. An Agricultural Class of paid apprentices has also been taken in connection with this Farm, to train up the boys in practical Agriculture, in order to prepare better qualified persons for employment in the Revenue Department. The boys will be trained for two years when they will very well be fit for the object they are intended for. Besides Ensilage, cattle breeding is also intended to be taken up. This is a very fine systematic start and if well managed, will prove an excellent model for the whole of Kattyawar.

Junaghur State has also been trying experiments in Indigo and Tobacco. Indigo is proved a great success, and is tried this year on a large scale. The Girnar is a good field to try some experiments on Coffee, Cinchona &c., which if successful, will be very remunerative to the State. It requires the personal attention of a practical and persevering man. Many other States have also employed graduates of Agricultural College, to improve and introduce new reforms in Agriculture whatever they can.

Instead of working singly, it will be more advantageous if all the States conjointly try to work for it. Local Fund System has long been working in Kattyawar, and if from this Fund, a large Model Farm be established under the superintendence of a good practical man, there will be a very large scope for experiments, and will do a great good to all concerned.

Well Wisher,
of
KATTYAWAR.

1. Trade and Navigation Report for July 1886. From Government of India
2. Report on the Cawnpore Experimental Station for the Kharif season 1885: From the Director of Agriculture, North-Western Provinces and Oudh.
3. Annual Report on the Government Cinchona Plantations in Bengal for 1885-86: From Bengal Government.
4. Journal of the Madras Agricultural Students' Association for April and May 1886: From the Association.
5. Annual Report of the Khandesh Experimental Farm for the year ending 31st March 1886: From the Director of Agriculture, Bombay.
6. Annual Report of the Hyderabad Experimental Farm for the year ending 31st March 1886: From the Director of Agriculture, Bombay.
7. Memorandum on the Prospects of the Cotton Crop in the Bombay Presidency: From the Director of Agriculture, Bombay.
8. Memorandum on the Extraction of alcohol from the prickly shrub: From the Government of India.
9. Journal of the Agri-Horticultural Society of India for September 1886. From the Secretary.

Thanks of the Editor are recorded for the above contributions.

RHEA.

In the Journal of the Agricultural and Horti-

valuable article on Rhea which contains very many useful informations on the subject. Thirty years ago the excellent qualities of the fibre obtained from the stems of the Rhea plant, *Boehmeria nivea,* were recognised by the Agri-Horticultural Society, and strenuous efforts were made from time to time to encourage the efforts of inventors, to provide some method of treatment under which the fibre could be produced at a cost that would bring it into general use, but no completely satisfactory results were obtained.

Since the middle of the year 1884, however, a considerable advance has been made in our knowledge of the best methods of preparing this fibre for the manufacturer, and it may now be definitely stated that all difficulties have been surmounted, and wherever Rhea can be grown, it can also be prepared for market in such a form that it will at once command a remunerative sale.

It is well known that the fibre of Rhea is contained in that part of the stem of the plant which lies between the wood and the outer bark, to both of which it adheres tenaciously, embedded in a mass of glutinous, resinous matter, from which it is most difficult to free it. In China this is accomplished by hand-stripping and washing, an expensive process which involves a serious loss of good fibre. M. Favier has invented a process of decortication by steam, which so loosens the bark together with the whole of the fibre from the wood, that it can instantly be stripped off without damage to the fibre.

In Indian grown Rhea which have been thus stripped, and similar stalks that have been decorticated by hand without the use of steam, the contrast is remarkable and quite conclusive. In the former case the wood is perfectly clean, and the stalks can be broken short like biscuit, but on the latter there still remains a considerable quantity of fibre adhering to the wood, which of course would be lost, and when it is considered that no more than five per cent. of fibre is contained in the green stems, it is a matter of consequence that the whole be secured. This is accomplished by the steaming process, and the ribbons so obtained may be dried, packed and shipped to England for subsequent treatment.

Comparison indicates a further superiority of fibres decorticated by steam, the inner surface being smooth and even, whilst in the case of those which have been stripped without the use of steam the fibre appears much lacerated, and this would involve a still further loss of fibre when the ungummed filasse is converted into slivers in the carding machine. It will be the aim of producers to furnish a staple which will compete for use in the manufacture of the most expensive fibres, because such a staple will command the highest range of prices, and it cannot sufficiently be impressed upon cultivators that whether their produce will compete in the market with hemp, with flax, or with silk, depends almost entirely upon the method they adopt for the production of fibre in the first instance. Although the fibre of Rhea is exceedingly strong, it is easily bruised and injured in the process of separating it from the stem, and the severe treatment to which it is subjected in the best machine yet introduced cannot fail to affect its ultimate value considerably.

It must, however be remembered that the Fremy process is specially adapted to de-gum steamed ribbons, and may not therefore have been the best chemical process for machined fibre. A machine may yet be produced, which will be a great improvement upon anything at present before the public. A machine that will remove the fibre from the stem and clean it at a small cost, and yield a product that will command a ready sale for many purposes. It is not alleged on behalf of Mr. Death's new machine that it can entirely remove all the resinous matter from the fibre. The machine of Death and Ellwood recently exhibited in Calcutta leaves about 15 per cent. of foreign matter still adhering to the fibre, possibly Mr. Death may have now succeeded in reducing that percentage, but some still remains which can only be removed by chemical treatment. So that after all, whether machined or not, the ultimate success of Rhea will depend on the completeness of the process by which it is rendered fit for the spinner.

This subject has long occupied the close attention of the distinguished French Chemist and Botanist Professor Fremy, whose scientific works have obtained for him a European reputation. M. Fremy and his associate M. Urbain have now brought their system of de-gumming Rhea to great perfection. Within the past few months important discoveries have been made respecting the chemical properties of the glutinous matter of the Rhea plant, which have enabled them to simplify and cheapen their process very considerably. But as it is well known that laboratory experiments, however successful, are apt to disappoint when applied in practical operations on a large scale, M. Fremy and his associate have established a Factory at Louviere, near Rouen, where many tons

of Rhea ribbons have been treated and the filasse worked up into yarn, in which form it is eagerly purchased by French manufacturers, who thoroughly appreciate its valuable qualities. A regular business has thus been created, which is only limited by the very small supplies obtainable of the raw material. In the meanwhile English manufacturers are by no means indifferent at the appearance of a staple that threatens to be a serious rival to silk and flax, and ultimately, perhaps, even to cotton, and before very long arrangements will doubtless be made to carry out the Fremy-Urbain process in this country.

A manufacturer (English) who had worked Rhea into dress material, remarked recently that it had only one serious disadvantage, and that was, that it would never wear out. He had presented his wife with a dress of Rhea fabric, it had been washed several times without in the least impairing its beauty. "Good," he said, "for the husbands, but bad for the wives, who would get tired of their dresses before they could make them shabby

Excellent results have also been obtained with the same material in the manufacture of damask table cloths, napkins, bed linen, and such like fabrics indicating a wide range of uses to which this fibre may be applied, so that all fear of over-production may be dismissed for a long time to come. But apart from European demand, when it is remembered that thousands of tons of China grass are annually manufactured into fabrics in China, Hankow exporting 8,000 tons per annum for local consumption, it becomes a question whether the same result will not follow in India, if the cultivation of Rhea should be taken up on a large scale, what an immense gain this would be to the country in every way, and there seems to be no reason why the Fremy-Urbain process of de-gumming the Favier ribbons should not be as successful, and managed as easily in Bengal as at Louviers. A superintendent with some knowledge of chemistry, and a man to look after the boiler would be necessary. The chief requisite seems to be a plentiful supply of soft water, and the means of getting rid of it; when charged with colouring matter it becomes as black as bottled stout. This last is a difficulty where the water supply is precious, and rivers may not be contaminated.

In preparing ribbons for the Fremy-Urbain process they may be greatly improved in value by removing as much as possible of the outer brown cuticle, this is effected by wiping the stems with some pressure with a rough cloth, while hot from the steaming chest.

In China this has been done with so much success that the ribbons thus prepared have yielded from 75 to 80 per cent. of fine filasse.

Ribbons not so treated yield from 45 to 55 per cent. of filasse. This means that freight has to be paid on at least 40 per cent. of useless material which might be saved by the removal of the cuticle before decortication. It will also probably cheapen to the chemical treatment by saving the expense of one boiling. Whether the extra cost of handling on the field will be less than the percentage saved in carriage and freight, will, of course, depend on circumstances of time and place. Cheap labour and high freight would be in favour of hand-cleaning. Dear labour and low freights might turn the scale the other way. Suppose 100 tons weight of Favier ribbons have been obtained, and the filasse contained therein amounts to 45 per cent, then—

	Tons.
The weight of filasse produced will be ...	45
And the weight of the waste will be	--
Total ...	100

But if these same ribbons had been thoroughly cleaned when removed from the steam chest, so that when converted into filasse, the yield would be 75 per cent. instead of 45 per cent., the actual weight of fibre would not be increased, but the bulk of useless waste would be greatly reduced, thus—

	Tons
Weight of filasse	45
Weight of waste	
Total ...	60

Or a saving of 40 tons in every 100. It is obvious, however, that the value of this deduction will depend on the percentage of fibre in the ribbons, which may be greater in China than in India, and may, in fact, vary in different parts of India.

The experiment at Glenrock the only place in India where Rhea is cultivated on a large scale has excited considerable local interest not only amongst the neighbouring planters, but also (*mirabile dictu* at this stage) amongst native cultivators as well; it is only the difficulty of obtaining plants that has hindered them from already beginning on their own account.

In Algiers the French have been growing Rhea with considerable success, and also in Egypt, and the earliest information on the subject has been derived from these sources, but their statistics do not seem to apply in Southern India where the conditions are so different. There is not, therefore, a great deal of

experience available for the benefit of would-be Rhea planters, and what there is must be studied in view of the circumstances under which it has been obtained. Every planter will have to find out for himself what treatment is best adapted for his own climate, soil, and other conditions.

Mr. Minchin, the able Manager of the Glenrock Estates, was sent out to India early in 1884 for the special purpose of introducing the cultivation of Rhea. On his voyage out he obtained a small supply of plants from Algiers, these were dug up and roughly packed in boxes, and after a long and, trying voyage at the hottest season of the year were delivered at Glenrock in the month of May. The roots were at once planted, and from them about 2,500 plants were obtained to start with. In the following November 200,000 plants had been obtained from the original stock by cuttings, layers and root division. These were again taken up and divided, and in June last the number of plants had been increased to about two millions. A remarkable example of arithmetical progression applied to agriculture deserves to be recorded. From one root planted to January seven stems were cut, each divided into five cuttings, three eyes to each cutting, most began to grow in a week; from the roots bulbous tubers formed nearly filling up all the space between the roots at 18 inches apart. From this one plant 57 strong root cuttings were taken, making in all 83 plants, from one root not five months in the ground, and that under unfavourable circumstances, poor soil, and no water or shade Again, a single root left undisturbed for a year had so increased in size that 42 stems were counted in various stages of growth.

The plants require to be left a whole year before they should be cut for fibre. During the second year only half a crop should be expected the yield of the third year will be greater, and from the fourth year full crops will be cut. This is Algerian experience, but it remains to be seen if the rule holds good in India. In Algiers they reckon the average weight of each stem when ready to cut to be 1½ oz., and they obtain ribbons to the weight of 10 per cent. of the green stems. Mr. Minchin states that the average weight of Glenrock green stem when mature is 3 ounces, but he has not hitherto obtained more than 7½ per cent. of ribbons. There can be no doubt that the growth is far more robust in India than in Algiers, and the plants too carry far more moisture, and this may account for the smaller percentage of ribbons to the green stuff cut. The season of cutting may also make a considerable difference. Then again all the French calculations are based on the results obtained from *Urtica tenacissima, Roxb*, whilst Mr. Minchin's refer to *Urtica Nivea.* He has both species in cultivation at Glenrock, and remarks on the great difference between them. The latter being far more robust in habit and quicker in growth, though it may be that experience will prove that the former will yield as good a crop when thoroughly established, and the smaller weight of stem may yield a higher percentage of ribbons. During the wet seasons the stems will certainly contain a far greater waste of moisture than at other times, and this is the case with *Urtica Nivea,* with stems 7 to 8 feet long, and weighing over 6 ounces each. It does not, however, follow that the actual weight of fibre will be less, neither can it be said that the same results would follow in different parts of India under different conditions of soil, temperature, rainfall, etc. These are points that each planter must find out from his own experience, and doubtless we shall all be very much wiser a few years hence.

Urtica candicans is also grown at Glenrock, about it. *Urtica Nivea* may be known by its leaves, the under-surface of which is silvery-white. in *Urtica tenacissima* the under-surface of the leaf is green.

The extraordinary rapidity with which the varieties of Urtica can be propagated by cuttings and root division, has already been referred to plants raised in this manner make new growth very quickly. In one month new shoots appear, in three months the shoots will be four feet high, and in six months there will be five or six strong stems. Separations of the tubers are, however, much slower in growth than cuttings, and in hot dry weather the best mode of propagation is by layering without complete separation.

Mr. Minchin sowed 2lbs. weight of seed on the 27th March occupying an area of 1,400 square feet, germination took place on the 3rd April. Much trouble was at first experienced with ants, but a little kerosine oil mixed with the water successfully kept off the depredators. In four months the seedlings were 18 inches high and strongly rooted, both cuttings and seedlings require partial shade till they are well established.

The French recommend their own system of planting out at 18 inches apart, so that each acre will contain 16,000 plants. This, no doubt, applies to the less vigorous species *Urtica tenacissima,* and in a climate less forcing than that of India.

At Glenrock Mr. Minchin has put in his plants in six-feet beds, separated by a one-foot drain, two rows in each bed 3 feet apart, and 18 inches between the plants on the row, so that in Glenrock

7,000 plants occupy an acre. He finds that the space between the plants quickly fill up with new growth, and the ground soon becomes quite covered.

Irrigation is a matter of considerable importance, as it will probably make a difference of one crop in the year.

A portion of the Glenrock plantings was left without any artificial watering, in order to observe the result. It was found that although root growth was not materially checked. there was scarcely any movement above ground between the months of February and May. On the irrigated fields the dry heat did not seem to affect the developement of the shoot in the least, in eleven days stems were observed to have grown 15 inches. Growth is more vigorour on the hollows than on ridges, or on level ground. At Glenrock the altitude above the sea is about 2,000 feet, and the rainfall is exceedingly heavy during the monsoon. Rhea is also being grown in the Bhowani Valley at the foot of the Neilgherrie Hills, in the Coimbatore district. Here, where the soil is rich and the climate very forcing the developement of the plant appears to be much more rapid and the growth more uniform and vigorous than at the greater altitude of the Wynaad. Close planting is strongly advocated in order to induce tall, straight growth and check the formation of side branches, it is also said to be a great protection from the ravages of caterpillars and other insect pests which devour the leaves, and so cause side growth.

As regards shading, the practice varies considerably in different countries. In the Indian Archipelago Rhea is planted under the shade of forest trees. In Algeria and in Egypt it is grown in the open field entirely exposed to the sun. Mr. Minchin advocates partial shade, and in clearing his forest land he has left some of the larger trees for this purpose.

Manure can scarcely be dispensed with, but the plant gratefully responds to every attention paid to it.

No crop for the purpose of fibre extraction should be expected until after the plants have been left undisturbed in the ground for at least 12 months, during which time the fields must be kept free from weeds, an expense that will not recur when the Rhea has thoroughty established itself. The cost of up-keep after the first year will, therefore, light in comparison with most other crops. When in full vigour, Rhea should afford in India from four to five crops in each year according to locality. The stems are said to be in their best condition for cutting when they begin to ripen, which may be known by their commencing to turn brown at the butt. An interesting account appeared some time ago in one of the Manchester papers of a visit to the Rhea plantation near Zagazig, on the Suez Railway, where there are over 300 acres of Rhea under cultivation, the property of the Ramie Company, of Egypt. Here it is said that no shade is necessary, and the fields are irrigated in the customary Egyptian manner. The treatment of the crop differs very materially from that recommended under the Favier system. It appears to be the practice in Egypt to cut the stems while still young and pale green in colour, and they do this because they find that when the stem once begins to change colour, the bark hardens, and the resinous matter becomes stronger and decortication almost impossible. Of course this is so and as the flowering stage approaches, the entire structure of the plant will be undergoing considerable changes, which, in all probability, will, to sone extent, affect the character of the fibre, as well as the bark and and the wood.

The steaming process enables the bark to be removed with all the fibre attached, at a much later period when the plant has reached its most perfect vigour, and when it is reasonable to assume that all its component parts are in their best possible condition. In Egypt the stems would then be 8 or 9 feet in length, but they cut them when from 4 to 5 feet long, and the delicate film of bark can then be easily stripped off the stalk by hand, and an hour's exposure to the sun is sufficient to dry it ready for packing. When removed from the half matured stem, the bark is described as "a thin pellucid ribbon as translucent as green Persian silk when in a moist state."

No doubt, in this condition, the gum will be much less tenacious than at a later period, and therefore more easily treated, but on the other hand the weight of fibre lost by premature cutting must be very considerable, and the decision as to which of these two systems most advantageous will turn upon the relative qualities of the filasse so produced. If there is but trifling difference in the value of the fibres, the balance af advantage must rest with the system that affords the heaviest crop.

Some notion of the probable crop may be arrived at from an interesting observation of Mr. Minchin's, who selected three one-year old plants, and on the 6th March cut them down close to the ground. On the 6th May following he cut from these three plants 62 stems, weighing in the agaregate 8½ lbs., anb on the 1st July he again cut from the same plants 83 stems weighing 11¼ lbs.

In April, stems 6 feet long when decorticated, yielded 7½ per cent. of their weight in ribbons, but in the rains the green stuff contained more water, and the percentage of ribbons was somewhat less.

In Algiers, where the ripe stems only average about an ounce and a half in weight, it is stated that an average yield of 10 per cent. of ribbons is obtained, whereas in India, owing to the greater vigour of Indian grown Rhea, the stems of which average three ounces in weight, the percentage of ribbons to the weight of the bulk may very well be much less, whilst the actual yield of fibre per acre may be as much as, or even more than, in Algeria.

It will be seen that an enormous quantity of green stuff must be cut and handled for every ton of fibre that is produced. One hundred pounds weight of green stems, after the leaves have been removed, will not yield more than 3lbs. of fibre. treated by the machine; the average will probably not exceed $2\frac{1}{2}$lbs The same weight of stems, when decorticated by steam, will furnish $7\frac{1}{2}$lbs. of dry ribbons. The process of decortication can be carried out on the field by the use of light easily portable steam generators, and this will render the carriage of but seven and a half per cent. of the gross weight necessary. Now the machine, (Death and Ellwood's patent) requires a strong pressure of water, and can only be used where there is an abundant supply of water, and either steam or water-power for driving. They must, therefore, be located where these requisites are available and the entire weight of green stuff must be carried to the mills. Fancy carrying 35 to 40 tons of stems for any distance to produce a single ton of machined fibre. It is in this direction that the planter must exercise all his ingenuity and close supervision to effect economy in labour and carriage to prevent his profits from being eaten up at the very first stage of treatment.

With these figures before them it will be possible for planters to draw up approximate estimates of the cost of treatment according to the scales of charges current in their several localities. Mr. Sammuel Jennings, the writer of the article in the Journal of the Agri-Horticultural Society, gives the following estimate of the crop—I will now proceed to furnish some idea of the probable crop to be expected. To obtain a ton of ribbons per acre, assuming the percentage obtained from the bulk to be 7 per cent., it will be necessary to cut 12,000lbs. weight of green stems, and assuming them to average eight stems to the pound, that will be 256,000 stems, so that if five crops are obtained in the year, it will be necessary to get 51,200 stems at each cutting from the acre, or per square yard (4,840 square yards = 1 acre), say $10\frac{1}{2}$ stems. To get two tons of ribbons per acre 21 stems must be cut from each square yard. At Glenrock in many places, over 30 mature stems have been counted to the measured square yard. Two tons of ribbons per acre is not, therefore, an unreasonable estimate of the probable yield of established cultivation in favourable localities. I have already stated that the dry ribbons produced by the Favier system of steam decortication will yield at least 45 per cent. of fine filasse when treated by the Fremy-Urbain process. If the yield per acre be two tons of ribbons, the produce in filasse will be 2,016lbs., the present market value of which is stated to be from seven pence to nine pence per lb., according to quality, the gross proceeds of the produce of one acre would therefore be £67-4, from which must be deducted the cost of cultivation, handling, treatment, carriage, drying, packing, freight, chemical treatment, commissions, etc., to ascertain nett results. I cannot, however, as yet say that there is a large present demand for the filasse of Rhea in England, for the simple season that no considerable quantity has yet been offered in the market, and manufacturers naturally hesitate going to the expense of altering their machinery to suit the new staple until they are relieved of uncertainty as to supply. The French manufacturers on the other hand will take as much as they can get at about the price I have quoted, and English and Irish manufacturers are ready to follow their example as soon as a definite and regular supply can be depended on. I have been personally assured by some that they are prepared to enter into contracts on a large scale, directly the supply can be guaranteed.

I do not, in the least, fear that Rhea coming to this market a couple of years hence will fail to find ready purchasers, because arrangements have already been made to obtain supplies from China and elsewhere, that will encourage the trade to expect regular shipments, and the present uncertainty will at once disappear, and as every one freely admits the valuable properties of the new staple, it will not be long before Rhea will take an important position amongst textile fabrics of British manufacture.

TECHNICAL EDUCATION.

This is a subject which is now attracting much attention in all the civilized countries of the world. Even England which of all the European countries was most sceptic about its usefulness has at last been rudely awakened to the importance of the subject by the pressing necessities of the times. They are being undersold in their own market as well as in the market of the world by their neighbours, the Belgians, the Dutch, and others who

have made technical education the groundwork of national education. In Europe, Germany especially, it is recognized that the groundwork of success in life can best be laid at school and that the old system of cramming a boy with algebra and classics is not the form of mental training which will prove as a rule of most use to him in after life. In Asia, Japan has fully understood the soundness of the European system and taken steps to introduce professional training in the curriculum of their schools and colleges. In India lads leave schools full of Carlyle and clasics, but without any special training which they can put to immediate use in commencing the battle of life. It is true that in many instances, they are allowed to leave the choice of occupation until their scholastic career has been completed, but this is probably the result rather than the cause of a defective system. The fact remains that boys are usually educated on precisely the same lines whether they are intended to follow agriculture, trade, or the professions. This is not economy, because it deprives the lad of many advantages he might and should have at the start and which must cost him time and labour to overtake. We contend that the farmer should have the groundwork of the special knowledge by which he is to earn his daily bread laid at school, whereas, however it may be with lads intended for other branches of industry, it is certain that the boy who is to be a farmer comes from school without any attempt having been made to fit him for his calling. This needs be remedied.

Farming in the future will be far more difficult than it has been in the past, and the next generation of agriculturists will need be very much smarter men than their fathers. We trust the times will greatly improve, although we confess we are not able to see clearly, as yet, where the improvement is to come from; but, however much they may mend, the farmer of the future will not be likely to eat much idle bread. Competition of every concievable kind will be heightened, and his wits will need be of the sharpest if he is to hold his own in the great international struggle for existence upon which the agriculturists of the world appear to have entered. He will need something more than rule of thumb to guide him. The system of Education should have to be modified. Schoolmasters should be expected to teach boys the natural sciences, and to teach them habits of observation. Structural and physiological botany would be more likely to be of use to the young farmer than algebra; he should come from school with a fair knowledge of the life history of the plants of the farm, not as farm crops, but as members of certain families and orders having characteristics in common. He should also have some general knowledge of entomology; all farm pests and their habits of life should be made familiar to him, and he would be likely to find such lore of greater practical value than the classics. Then there is agricultural chemistry, much of which could be taught in an elementary way at schools, together with the measurement of land and stacks and timber by actual practice, and much more information on kindred subjects, which would be so much stock-in-trade to the young farmer when he finds himself actually on the land.

Possibly some may still be found who will be inclined to jeer at the idea of giving boys technical agricultural education at school; but knowledge is power, and the man who starts with the power which knowledge gives can afford to be laughed at by those who consider any departure from rule of thumb a sign of incapacity. The man who has to drive a nail in the dark deals many useless blows and wastes much of his strength. Practice without science means repetition of errors which represent losses, and the times are not now good enough to support such a system. We repeat that the subject of technical education at schools will repay the study of those who are now having their boys educated in the school.

In India which, in comparison with England and other European countries, is immeasurably behind hand in trade and commerce, for technical Education, taken in its broadest acceptance, to bear any substantial fruit, it must go hand in hand at least to begin with, with State protection without which to talk of technical education would be a meaningless twaddle.

FOOD ADULTERATIONS.

The agitation over the *ghee* question has not yet subsided. It reflects a good deal of credit on Government for the zeal and expediency with which it has come forward to meet the evil. We can only hope for its speedy suppression but if we are to credit the evidence of other countries, we can not persuade ourselves to believe that the fraudulent and disgusting practice once introduced in the *ghee* trade will ever be totally extinguished. Th unsophisticated public takes legislation as ae panacea for all evils; and now that the Gov ernment has passed stringent measures, for the suppression

of the evil practice, the public will in short time sink into a helpless state of apathy, only the more remarkable for the fervid excitement during the earlier days of the agitation The unscrupulous adventurers who have so successfully carried on this campaign have no reason to be sorry; they are quietly looking over our cards. and however adroitly the government may manage them for us, they will have at the end all the tricks to themselves. We shall be made to swallow before long as much lard and beef-fat as ever, only with less grumbling and prejudice; in course of time the adulteration of *ghee* with all kinds of abominations will pass off as a matter of course.

We think it might be interesting to our readers if we took a brief survey of the subject of food adulterations and other numerous frauds practised on the lay public by provision dealers. In this country, we are singularly happy in this matter, the very simplicity of our diet and, indeed of our taste, baffles any considerable adulteration with our articles of food. The adulteration of ghee is only a very recent complaint, but that of milk, at least in the metropolis, is a standing grievance. It is so much the more to be regretted that in spite of visible improvements in other branches of trade and industry, milk, the only nutritious substance of our dietary, remains to this day as bad as ever. The evils arising from using adulterated milk are mainly threefold. First, being mixed with water, its nutritive power is greatly diminished; much more is this the case when the milk has been previously skimmed. and thus deprived of its fat which is by far the best part of its nutritive ingredients. Besides water, however pure it may be, is liable to act perniciously on the health of tender babes and invalids. Actual experience confirms that calves if fed on mother's milk drawn hot and mixed with water, will quickly die; and if comparative physiology is to be depended upon, there is no reason why we should be astonished at the prodigious mortality among infants. Secondly, that in some cases, and not unfrequently in Calcutta, milkmen resort to the practice of adding chalk and other extraneous substances to give the apparance of greater strength to milk; such substances, though scarcely deleterious, can hardly fail to be so when persistently introduced into the system. And thirdly, there is a more subtle way in which milk may convey into our system such fatal germs of disease as those of cholera and typhoid fever; repeated outbreaks of the latter in and around London and Edinburgh have indeed been traced to the adulteration of milk with infected water. Thus in times of epidemics, it becomes doubly necessary that we should be strict in the use of milk suspected in any way of being tampered with. The adulteration of *ghee* with fat is in our opinion far less dangerous, as the latter must be thoroughly heated and boiled before it is mixed up with the *ghee*. However, the very idea that the only real luxury among our articles of food should be so scandalously tampered with is enough to justify a crusade against the malefactors, not to speak of the violent shock it has given to the religious susceptibilities of the nation.

Turning from India to Europe where the diet and taste of the people are as complex as the very science which caters for them, we discover that the process of deliberate poisoning in the civilized countries of the West, is far more active than among ourselves. A cursory analysis of the dietary of an Englishman gives, in the first place, bread as the "staff of life," tea, coffee, chocolate, cocoa and wine among his beverages; bacon and eggs, fish less often fresh than smoked or otherwise preserved, beef, mutton and pork; vegetables such as the potato, cabbage, peas, turnips, broccoli, etc; preserves as jams and jellies to which he is particularly partial; cheese and butter, sugar and milk, vinegar and a host of sweets, pastry and sauces which his active brain has manufactured out of the vegetable resources of nature. In his own house, he will insist upon enjoying these while fresh; but abroad, at sea and in the army, he is a voracious eater of all kinds of preserved food, apparently prefering the tinned salmon and herrings of his native seas to the fresh savoury fish of foreign countries, and his mania for jams and jellies remain as incurable as ever. We will examine only a few among his chief articles of diet and try to demonstrate to the reader what a brisk process of poisoning is systematically practised on an entire nation by millionaire English manufacturers, who are probably the first among the people of the world to vaunt of fair dealing and humanity. Some years ago, Dr. Hassell, a celebrated microscopist of our day, was employed by the proprietors of the Lancet to report upon the hygieinic aspects of articles of food; a brief description of his reports as appeared in the Lancet is given in the Encyclopœdia Britannica, 8th edition p. 769-70; a perusal of this most interesting article will convince one that despite cartloads of statutes enacted for the suppression of adulterations, the English public still remain at the mercy of unscrupulous manufacturers who carry on their game with as perfect impunity as if they had been a band of philanthropists. Every sample of bread—forty-nine in number—examined by Dr. Hassell contained on an average 82 grains of alum. A person consuming two such

loaves a week introduced into his system in that period 2 drachms and 44 grains of alum—a quantity which, as alum is a powerful astringent, will not fail to be injurious, and which probably produces much of the dyspepsia of large towns. Such is the case with the Europeans' "staff of life." Other articles of diet, however, fare much worse. Tea is in a very lamentable state, for it is meddled with both by the Chinse and those through whose hands it passes. Some teas are not teas at all, but entirely leaves of other plants; but where even genuine tea leaves are employed, the case is still worse; such teas are very often, colouerd with plumbago,, Prussian blue logwood, talc, and although we can not ta'e particular objection to plumbago, logwood, and take from a toxicological point of view, and only pass them on as simple frauds, the addition of Prussian blue is calculated to have very serious effects upon the health. Cocoa and chocolate are largely mixed with red ferruginous earth to increase the bulk and heighten the colour, and sometimes with such dangerous poisons as red lead and vermilion. The common curry powder, much in demand now with the English housewife, frequently contains red lead, although the preparation is so simple than we can not account for its adulteration in any other way than the deliberate meddling of wholesale dealers. Pickles and preserved vegetables such as olives, green peas and French beans, are invariably coloured with salts of copper often in quantities enough to produce speedy death. This too, is often the case with preserves The most daring of all adulterations, however, is that of sugar confectionery. Among the substances thus employed may be mentioned red oxide of lead, carbonates of lead and copper, chromate of lead, bisulphurite of mercury and arsenite of copper. Accordingly, from time to time, cases of virulent poisoning arise from the use of these coloured articles of sugar confectionary. European governments are very careful that lives should not be unnecessarily jeopardized in any way. In coal mines, the use of safety lamps is enforced; the hours of labour for women and children cut down by successive statutes; chimneysweeps must not be allowed to get up the chimneys; and in numerous other ways shewing in each case that keen interest in the safety and conservation of life which humanity dictates. But Parliaments and Statesmen look on with helpless amazement at the deliberate poisoning of man by man, boldly carried on under their very nose.

CULTIVATION AND TRADE OF WHEAT IN BENGAL.

Attention has been drawn to the importance which wheat occupies in Indian agriculture, since the recent development of the export trade in that article. The abolition in 1873 of the export duty on Indian wheat laid the foundation of the wheat export trade which has now attained to large dimensions. The low prices of wheat in England in 1884 where most of our wheat is exported checked the trade to a certain extent but the check was only a temporary one. In the trade and navigation report we see that in the past 4 months, April to July, the value of Indian wheat exported stood at Rs. 3,99,55,328 against Rs. 2,79,84,387 and Rs. 2,38,20,736 during the corresponding four months of 1885 and 1885.

Wheat is grown to some extent in almost every district but the great wheat producing tracts of India are in the North. In the Province of Bengal wheat is largely grown in Behar but no reliable figures could be had of the total acreage. Attention has lately been drawn by Mr. Finucane, the Director of Agriculture, Bengal, to a white variety of wheat which is largely grown in Behar in the district of Shahadad. This is one of the best if not the best sample of wheat grown in India, but it has hitherto remained almost unknown to the trade. If an impetus be given to the cultivation and export of this wheat, it has every chance of largely engrossing the Calcutta trade and seriously checking the export trade from the North Western Provinces, over which Behar possesses the advantage of having a shorter communication by rail. Hitherto various attempts had been made to introduce in Bengal better varieties of wheat from Cawnpore and other places, and the value of Buxar wheat was not known, nor recognized The officers of the Agricultural Department and various other persons interested in the cultivation of wheat is now engaged in experementing upon this and trying, if possible, to spread its cultivation in Bengal, especially Behar.

The quality of the grain is high English to satisfy the demands of English millers but still the Indian sells at a much lower price than any other wheat in the English market. This is due to adulteration with dert and foreign seeds. Attempts had at various times been made by the Government of India as well as local Governments to prevent this adulteration. Tracts had been published and freely distributed to learts our agriculturists better system of cultivation, they had been repeatedly told and advised to grow no other crop with wheat, and to remember that understand

wheat pays better than adulterated wheat but to all these gratuitous advices, they had turned deaf ears.

Apparently they seem to be very ignorant and not to know their own interest. But they are far from being so. They have more common sense than they are usually given the credit for. Mr. Finucane very shrewdly observes that the problem of prevention of wheat adulteration is not so very easy of solution as one is apt to think. Absolutely there is no market for unadulterated wheat. Be the quality of the grain supplied the best possible, the Calcutta merchants will deduct 5 per cent and pay for the balance. If this state of things is allowed to continue, it is the interest of cultivators and grain-dealers to mix dirt and foreign matter with it. As long as this uniform rate of refraction is not abolished and the system of valuation on merit established, it would be unreasonable for the trade to expect any better grain than what it now gets. The manager of the Moharajah of Dumraon wanted to grow a large area of wheat and send to the market u adulterated well cleaned sample, but when he saw that he would get no better price for his cleaner sample, he gave up the project altogether. The question of abolishing uniform rate of refraction was referred to the Calcutta Chamber of Commerce who considering the present depressed state of trade declined to co-operate. On this the Director of Agriculture naively remarks, "the Government ought to teach the agriculturists to at least mix 5 per cent of dirt with their grain before selling."

Next as to the question of large percentage of of foreign seeds mixed with the grain, it is known that it is not due to wilful adulteration but incident to the system of cultivation pursued by our poor cultivator. "He grows wheat not as an experiment but as one of his modes of making an honest living. He therefore grows wheat in the way that experience shows will pay him best." He can ill afford to grow wheat a one, for if the leather proves unfavourabw and his wheat fails, it would mean ruin to him, while if two or more crops are in the ground, he is sure to get some return for his outlay. Those who are intersted in the question of wheat trade in India, we refer to the able article on this subject in the first volume of this Gazette, page 201.

NEWS.

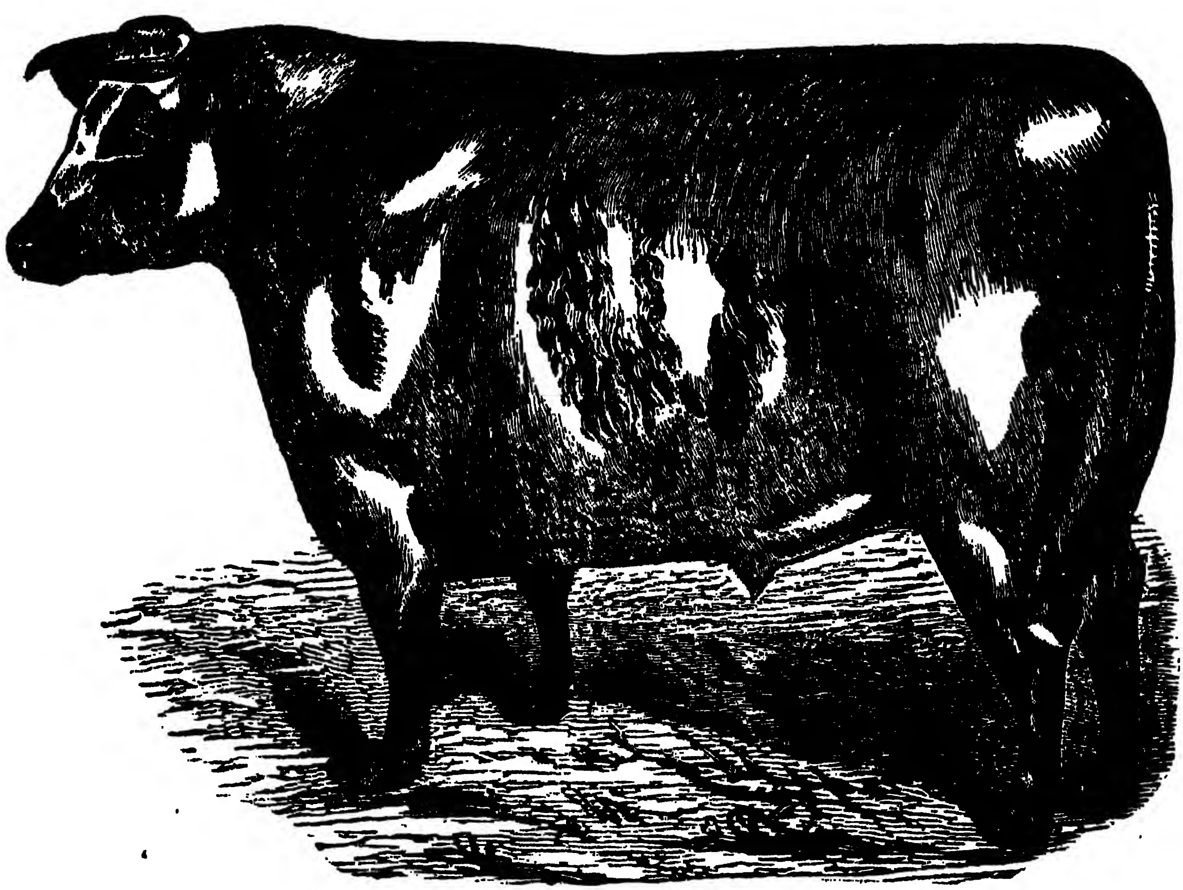
The Royal Veterinary College in England was founded in 1791, and incorporated in 1875, and is the only teaching school in England. Only animals the property of subscribers are received into the infirmary connected with the College, which has accomodation for 100 horses and a small number of dogs. There are about 250 students in the College, 102 of whom entered during the last educational year, this being the largest entry on record. During the year 884 cases were admitted into the infirmary, against 855 for the previous twelve months. The number of horses examined for soundness was 1,032, the number in the previous year being 1,145. In addition to the instruction of students and the treatment of subscribers' animals, there is a department for gratuitous advice, in which, on certain days, animals can be examined and treated on the payment of a mere nominal sum.

Cheaper Wheat.—Some interesting correspondence has taken place between the Bombay Director of Agriculture and the Revenue Department relative to the trial of a new wheat-threshing machine on the Kandesh Experimental Farm. The experiments took place last April, and seem to have been on the whole singularly successful. The grain as threshed out by the machine, was much cleaner than that produced by the ordinary treading-out process, and the cost of threshing is estimated at not more than one anna per Bengal maund; whereas at present it costs from six to eight annas. To quote the words of the Superintendent of the Khandesh Garden, these results seem to show that "the time has now arrived for the introduction of steam machinery to aid in the development of an industry which is second to cotton itself."

An International Exhibition will be held at Adelaide in 1887, to celebrate the attainment by South Australia of its fiftieth year as a colony. Applications for space must be sent in by the 1st of January.

New Fish and Meat Preserving Process—A large company of scientific gentlemen met lately at the Criterion for the purpose of examining the "Roosen" process of preserving fish, meat, and all kinds of food. The "Roosen" process consists in placing the fish or meat in a steel cask containing a solution of boracic acid and salt and water, after which pressure is applied and the cask hermetically sealed. Two cask of salmon thus preserved formed part of the luncheon. The salmon proved of excellent flavour, and there was nothing either in its appearance or taste to indicate that it had not been recently caught. It is claimed that under the "Roosen" process fish can be kept for forty-two days and meat for five months. Dr. Day said he did not think that any process invented during the present century would prove more useful to man than that which they assembled to investigate. Sir Joseph Fayrer expressed his belief that the process would supersede all other methods of preserving food. Sir Guyer Hunter mentioned that Mr. Zwiorzchoski had successfully applied the process to strawberries and other fruit, as well as to fish and meat.

SHORT-HORN



PRIZE BULL

The Immediate effect of the sugar bounty in Germany was to vastly stimulate the export trade. In 1876 the export amounted to no more than 500 000 cwts. But in 1885 more than 6,000,000 cwts. were exported, i. e., more than half the total product of beet sugar in Germany. In 1884 the German taxpayers paid out about £1,000,000 for bounties on this sugar. In 1885 the amount probably was £12,000,000.

As a resume of the practical working of mills of various kinds in which European machinery has been set up, the strange and unexpected fact has been discovered that Europe possesses no oil-pressing machinery that can equal the ancient Indian "ghanee." The men who have decided that the best of the European oil mills cannot compete with the Indian "ghanee" are not Indians, but Europeans—not dreamers or lecturers, but practical mechanical engineers, who are putting their money and enterprise into oil mills in this country, and adopting the "ghanee" system deliberately and in preference to the English system. These men have made two alterations in the "ghanee" system—one of which is to substitute iron for wood in the "ghanee" and the other to displace the bullock by steam power. But it is still the identical "ghanee" of centuries ago. The alterations thus made enable it to work at a great advantage, and make it so much more profitable that while hydraulic pressing has been found unremunerative in this country, the "ghanee" system has worked profitably. There seems now to be a consensus of opinion that the "ghanee" system cannot be improved upon.—*Madras Times.*

An attempt to grow hops at the Government Botanical Gardens at Utakamand promises to be successful. The Government takes great interest in the experiment, for, if successful, it will prove of great advantage to the rayats of the Nilgiri Hills.

The Bhopal Transit Duties.—The liberal policy which has been inaugurated by the States of Gwalior and Indor in the abolition of transit duties is about to be followed by the last important State in Central India in which these ones prevail. It is announced that from the 1st October next her Highness the Begum of Bhopal will remove the transit duties throughout her territories. The advantage of this liberal policy will be felt in the traffic receipts of the Midland and Rajputana-Malwa Railways.

There has been almost continuous rain in Nepal for nearly a month, and the downpour is proving injurious alike to the people and the crops. Some fine weather is now sadly wanted.

The Burma Rice Crop.—White rice has again advanced, the price for prompt delivery being now about Rs. 255 to 260. There is a strong demand for Upper Burma, owing, doubtless, to the inundations, which are believed to have caused some destruction to stored grain. Freight to the Straits is again easier, and this will probably tell on shipments to that quarter. Nagasaing paddy still continues firm, prices ranging from Rs. 97 to Rs. 98 per 100 baskets, although one local firm is giving 1 per cent. allowance over and above the market. It is pretty certain that there is not more than 1½ annas of the crop still lying in the jungle and another six weeks ought to see us at the end of fair supplies that is, as they are now coming in.—*Rangoon Times.*

Bourano Lace.—Bourano lace is a variety much sought after by connoisseurs, on account of its exquisite workmanship, and the proportionate difficulty with which specimens can be obtained—its production in the island of that name having become extinct. In the period of decay which followed in Venice—near which the island is situated—upon the Austrian accession, the art was allowed to lapse, although, up to that time, it had been the chief means of earning a livelihood to the whole population. At the instance of the Queen of Italy, girls were trained to imitate the lace formerly produced; but though they become expert workers they failed to use the correct stitch, notwithstanding the careful unravelling of ancient specimens. The art was apparently irrevocably lost, when, to the great joy of those who had so long preserved to recover it, an old woman who, in her youth, had known the stitch, was discovered. Under her tuition, the industry has been revive

The Madras Chamber of Commerce has memorialised the Government of India in favour of a reimposition of the Import duties.

The estimated outturn of the Bengal indigo crop is about 20,000 maunds, but it may yet be a little in excess of that amount, to judge from the improved reports from Bhagulpur. The accounts from Bihar show that the prospects of the Khoontees have become worse rather than better owing to the excessive rainfall and the damage done by caterpillars. The yield from the Khoontees is not expected to exceed 15,000 maunds. Heavy and continuous rain has also further affected the prospects in the Benares district, but the reports from the Doab are rather more favourable, and the yield from the plant is better than that of last year.

Steam Thrashing Machinery specially designed for India.—Our notes on this class of Machinery would not be complete if we were to pass over the "Malda" single crank, single blast Thrashing machine for which we notice Mr Arthur Butler, of Mozufferpore, is agent. At a Government trial in Italy recently, one of these machines competed against 9 English, 8 German, 2 Italian and 3 French machines, all of the best makers, and gained the gold medal. With a 2½ feet wide drum it thrashed out and dressed the enormous quantity of 3,000 kilos of wheat in 3 hours or at the rate of 32 bushels in one hour and was worked by a Brown and May's 2½ H. P. portable engine. The simplex machine, as it is called, will also thrash rice, even in the wettest condition, as it has ample fall and space, and no awkward places to choke. The advantages of having only a single crank, and doing away with a number of cranks, bearing pulley, belts, &c., is obvious. A

straw cutting and bruising apparatus for making *bhoosa*, can also be either fixed on to the machine, or mounted separately on wheels, as a distinct machine. There is also a very ingenious, light and efficient elevator attached for delivering into carts or stacks.—*I. P. Gazette.*

A Company called the Haidarabad-Dekkan Company Limited, has been registered in London, with a capital of £1,000,000, in 100,000 shares of £10 each, for the purpose of taking up the concessions made by the Nizam to Messrs Watson and Stewart relating to certain mining and other rights in the Nizam's Dominions.

The actual receipts from six sales of Bengal opium and five month's pass duty on opium exported from Bombay have been Rs. 4,21,91,106, which is Rs. 10,16,60 better than the estimate. The receipts from Bengal opium were Rs. 13 65,450 below the estimate, but those from Bombay were Rs. 23,81,660 above it.

The total exports of Tea from Calcutta during the season amount to no less than 19,247,486 lbs., as against 19,103,753 lbs. at the same date in 1885 and 16,590 630 lbs in 1884. In August, the exports to Great Britain were 8,714 534 lbs. while the trade with America showed a large increase. The Ceylon trade is also making rapid progress, the exports up to the 26th ultimo being nearly double those of last year.

Paper-making in Siam.—Native paper is manufactured in Siam from the bark of a tree called *tou koi* and the following is the process of manufacture The smaller branches of the tree are cut and steeped in water for two or three days, the bark then is stripped off and brought in bundless and sold to persons who make the paper. The boundles of bark are put in water for two or three days by the paper-maker, and having been cleansed from dirt are taken and steamed over a slow fire for two days, a little clean stone lime being sprinkled through the bark. It is then steeped in water in earthen jars, and more lime is added. After a few days it is taken out of the jars, and having been well washed to free it from the lime, it is beaten with a mallet until it becoms a mass of soft pulp. A frame of netting about six feet long, and of width varying from eighteen to five inches, is set afloat in water and the pulp having first been again mixed up in water is skilfully poured out on to the frame so as to be equally distributed over it. The frame, is then lifted out of the water and a small wooden roller is run over the surface of the pulp. By this process the water is squeezed out and the pulp pressed together. The frame with the pulp on it is then set to dry in the sun and in the course of about ten hours, it is quite dry and the sheet of paper is then lifted off the frame. The surface is then smoothed by applying a thin paste of rice flour and then rubbing it with a smooth stone. A black paper which is written on with a slate pencil is made by colouring the surface with the mixture of charcoal. The paper-making industry in Siam is burdened by a heavy tax varying from 7 per cent. on the best quality of paper to 100 per cent on the commoner sorts. Native manufacturers are but few and in consequence of this heavy impost, the industry itself cannot develop to any considerable extent.

On Continent—in the Germany, in Belgium and in France—commercial education is a serious business. In Germany alone there are between two and three hundred commercial schools and museums; in France there are several while, Belgium, in the Institute Superieur de Commerce at Antwerp has the oldest and the best of them all. The curriculum of the Ecole des Hautes Etudes Commerciales, founded in Paris two years ago, is an exact copy of that which the produced such uniformly excellent results at Antwerp. Obviously the first essential of a good commercial education is a knowledge, a speaking and writing, not a more reading knowledge of foreign languages. At the Continental commercial schools, English, French, and German are taught thoroughly to every student, and at Antwop we believe, Italian, Spanish and Dutch are added. Thus every young man who passes through the usual course of study comes out with an excellent knowledge of six modern languages—an equipment of simply inestimable value to any man, whatever his position in life. Geography as a living science and not the weary task of school books comes next; and it is taught by the aid of official reports, Blue Books, Yellow Books, Buff Books, and records of travel. Latitudes and longitudes are details less insisted upon than accurate knowledge of the volume of imports and exports. It is generally forgotten that the origin and progress of international trade constitute a fascinating history; but they do not forget it at these commercial schools and the economic history of every small British colony is as carefully studied as that of the most powerful empire.

Messrs. William Moran & Co.'s Market Report of 11th September.—There is but little change to report in the general prospects of the crop since our last issue. The figures given in the estimates for Lower Bengal have been generally confirmed, the only difference being that the latest returns from Bhagulpur are a little in excess of the figures previously given. The weather in Behar during the past fortnight has not been at all favourable for *khoontees*, there having been too much rain everywhere, and caterpillars have also appeared and done a good deal of harm at many factories. Fine weather for the future may help the outturn to some extent, but at present we doubt whether the *khoontee* yield will much exceed 15000 maunds. There is no improvement in the Benares zillahs, where there have been further heavy and continuous falls of rain, but the advices from the Doab are rather better, and the yield from the plant compares very favourably with that of last season. We may expect a total of about 125,000 maunds. The declarations for the London October sales commencing 11th October amount to 61,00 chests, of which 2,000 chests only are Bengals and Oudes, and 4,100 chests Kurpa and Madras.

PASTEUR AND HIS WORK, FROM AN AGRICULTURAL AND VETERINARY POINT OF VIEW.

By George Fleming, L. L. D, F. R C V, S.,
Principal Veterinary Surgeon of the Army.

(*Continued from the last number*)

It has long been noticed that vinegar, when kept for sometime, becomes turbid and impoverished in a remarkable manner, and finally becomes putrid. Pasteur pointed out the cause of this, and also the remedy. After the alcohol has become changed into acetic acid, the mycoderm still exists, as it can live upon the acid - beginning with the ethereal and aromatic portion, the most valuable—transforming it into carbonic acid and water, and leaving a small quantity of mineral salts and albuminous matter the decomposed remains of the plant. This neutral organic fluid is a suitable home for moulds and putrefactive organisms, which consequently rapidly grow, the moulds forming a film over the mass beneath, in which anaerobic organisms can consume the dead mycoderms; and thus we have putrefaction in the deeper parts, and combustion at the surface. Minute eel-like organisms also appear in vinegar, and rapidly deteriorate it. It is asserted that there is not a barrel of vinegar manufactured on the now obsolete Orleans system which does not contain them in immense numbers, and, astonishing to mention, they were, previous to Pasteur's investigations, actually considered necessary to the production of vinegar. The mischief wrought by these mycroscopic creatures is owing to their requiring air to live—like the Mycoderma, they are aerobic; and when the vinegar reaches a certain depth, they form a moving stratum in the upper part of the liquid, where they can obtain air. Here, however, they come into competition with the mycoderms for the essential oxygen which they both must have, and there ensues a struggle for existence. If, for some reason, the film of mycoderms is not formed, or its production is delayed, the ever moving little eels take possession of the surface of the vinegar and absorb all the oxygen; consequently, the mycoderm cannot develop, or it dies. But if acetification is very active, and the plant has occupied the upper strata, the eels are gradually driven away, and take refuge against the sides of the vessel, where they compose a thick grey lining, which is all in movement, and where their enemy cannot so seriously injure them, since they are surrounded with air. Deeper in the fluid they would perish, and they only linger at the sides of the barrel until they get an opportunity to again contend with their vegetable enemy. Pasteur's intervention removed the evil: the vats are thoroughly and frequently cleaned, so that the organisms have no time to do any harm.

Guided by his studies on vinegar, Pasteur has been able to effect great improvements in the manufacture of beer and wine, by which production is cheapened, and the keeping properties of the liquids much enhanced.

These improvements are founded upon the observed injurious effects of the organisms which give rise to the acetic, lactic, and butyric fermentations; and the measures adopted to prevent them are most simple and effective—the process now being known as "Pasteuriation." With regard to beer, he recommended that it should be bottled when fermentation is nearly completed, and the bottles then subjected to a temperature of between 122° and 131° Fahr., so as to destroy all injurious germs. The wort, while cooling, was also to be guarded against all atmospheric germs, and the leaven employed for making it was likewise to be free from them. Wine has its own peculiar micro-organism—the *Mycoderma vini*—which feeds on new wine, but does as this becomes old. The vinegar ferment cannot live upon new wine, but as soon as the *Mycoderma vini* perishes and decays, the *M. aceti* attacks it and grows rapidly, so that, the wine becomes sour. "Flat" wine, and "greasy" wine (peculiar to the white wines of Loire basin) as well as the "bitterness" of Burgundy wines, are also due to particular microscopical organisms. The ageing of wine mainly depends on its oxidation, the oxygen which was previously mixed in a mechanical manner with it becoming chemically incorporated in it; for new wine, when destitute of air, does not age, and the difficulty in managing wine is to permit a certain amount of air to be present without any deteriorating germs. M. Radot, in alluding to this subject, says:—"In short according to Pasteur's observations, the deterioration of wines should not in any case be attributed to a natural working of the constituents of the wine, proceeding from a sort of interior spontaneous movement, which would only be affected by variations of temperature or atmospheric pressure; they are on the contrary, exclusively dependent on microscopic organisms, the germs of which exist in the wine from the moment of the original fermentation which gave it birth. What vast multitudes of germs of every kind must there not be introduced into every vintage-tub! What modifications do we not meet with in the leaves and in the fruit of each individual spoilt vine! How numerous are the varieties of organic dust to be found on the stems the bunches, on the surface of the grapes, on the imple-

ments of the grape-gatherers! What varieties of moulds and mildews? A vast proportion of these germs are evidently sterilised by the wine, the composition of which, being at the same time acid, alcoholic, and destitute of air, is so little favourable to life. But is it be wondered at that some of these exterior germs—so numerous, and possessing in a more or less marked degree the anærobic character—should find, at certain moments in the state of the wine the proper conditions for their existence and multiplication?"

To protect the wines from these injurious organisms, Pasteur demonstrated that it was only necessary to heat them, when bottled, to a temperature of 140° Fahr. for a few moments, in a water-bath. This insures the future soundness of the wine. After having shown the causes which determine the alterations in wine, by introducing a means of practically neutralising them, Pasteur solved one of the greatest economic questions with regard to this industry. By the application of heat, and without injuring their colour or flavour, the limpidity of all wines was guranteed, while their indefinite preservation was certain if kept in well-closed bottles, or in barrels, even if transported all over the world.

An amusing incident is related in connection with this discovery. Those most concerned in the preservation of wine were at first incredulous as to the heating process not damaging its taste, colour, or limpidness; and Pasteur addressed himself first to wine-merchants and others who were skilled in the detection of alterations in it, with a view to obtain a decisive opinion—for the public had already shown a perference for his heated wine; and at last he organised a large tasting Commission appointed by the wholesale wine-merchants of Paris. This body, at its first meeting, could not agree as to the superiority of the heated or unheated wines placed before them, many of them thinking the latter had a better flavour than the former; and Pasteur, fancying that prejudice had much to do in influencing them, intimated that at the next meeting there would be no indication as to which was the heated and the unprepared wine, but their palates should alone distinguish them. On that occasion, he offered them samples taken from the same bottle, and, as might be expected, there were preferences for one and for the other, the experts not knowing they were from the same source. The Commission, alluding to this experiment, candidly confessed that the differences between the heated and non-heated wines were imperceptible, if they existed, and that the imagination was not without considerable influence in wine-tasting.

The researches of Pasteur had revealed a world of organisms, whose minuteness had hitherto either enabled them to escape observation, or to conceal their special function in the economy of nature; and the origin of these wonderful living particles, whose operations are so vast and important in their results, could not but arrest attention. Indeed the question of spontaneous generation, upon which grave issues in pathology in particular depended, was one which Pasteur was in a manner compelled to take up. It was certainly one that had come down to our own day from hoary antiquity, but it was being debated with unusual warmth while he was successfully unravelling mysterious processes, which he traced to the action of mycroscopical germs whose source might be ascribed to a spontaneous or fortuitous combination of elements. Aristotle was of opinion that all damp bodies which become dry, and dry ones which become damp engender animal life; Virgil thought bees were produced from the putrefied intestines of a young bull; and, much nearer our own time, Van Helmont stated that the smells that rise from marshes produce frogs, leeches, slugs, &c.,—nay, he had even the temerity to assert that mice could be produced by keeping a dirty shirt in the mouth of a vessel containing a little corn, which is transformed into these creatures after a number of days—he had witnessed it! and scorpions could be developed from crushed herbs placed in a hole in a brick! In the last century, Needham maintained the doctrine of spontaneous generation but Spallanzani opposed it; Redi, an Italian naturalist, showed the maggots are not spontaneously developed in meat, but come from the eggs of flies. The introduction of the microscope was seized upon by the "Spontaneists" to support their notions, as in no way could the appearance of animalculæ in previously barren fluids be accounted for Mistakes might have been made with regard to the origin of mice and maggots, but it could not be so in the case of microscopic living things. How, except by spontaneous generation, could the presence and rapid multiplication of these in decomposing animal or vegetable substances be explained? Buffon even lent himself to this doctrine, and devised a system in explanation of the hypothesis. In 1858 Pouchet, Director of the Museum of Natural History at Rouen, declared before the Academy of Sciences that he had succeeded in demonstrating, in an absolutely certain manner, the existence of certain microscopic living organisms which had been developed without pre-existing germs.

In a series of ingenious and ably-conducted experiments, Pasteur demolished, one after another, the arguments of Pouchet and the other heterogen-

ists, by convincing demonstrations. "There is not one circumstance known at the present day," he exclaimed in a discourse at the Sorbonne, "which justifies the assertion that microscopic organism come into the world without germs, or without parents like themselves. Those who maintain the contrary have been dupes of illusions and of badly conducted experiments, tainted with errors which they knew not how to perceive. Spontaneous generation is a chimera.

And Flourens, permanent Secretary of the Academy, hitherto neutral in the discussion, said on the same occasion: "As long as my opinion was not formed I had nothing to say; now it is formed I can speak. The experiments are decisive: If spontaneous generation be a fact, what is necessary for production of animalculæ? Air and putrescible liquids. Now Pasteur puts together air and putrescible liquids, and nothing is produced. Spontaneous generation, then, has no existence. Those who still doubt have failed to grasp the question." Subsequently, in England, Dr. Bastian became the strenuous advocate of spontaneous generation, but the crucial experiments and absolutely convincing demonstrations of Professor Tyndall, finally abolished the erroneous ideas which had prevailed for so many centuries.

As is well known, the production of silk forms the principal industry of several Departments in the South of France, and the rearing of silkworms occupies the time and attention of great numbers of people chiefly agriculturists. Previous to 1349, this industry had been particularly flourishing; but in that year, after an exceptionally good silk-harvest, and without any appreciable cause, several of the large establishments were visited by disease among the worms, and this is the course of time assumed the proportions of a plague among the silkworm-nurseries, until at last the silk-husbandary of France was on the verge of ruin. The symptoms of the disease were numerous and variable, and sometimes the worms died early, at other times not before the first, second, or third moulting; oftentimes the eggs were sterile. Instead of becoming white, the worms returned a rusty tint; they did not eat; spots appeared on their bodies like black bruises, which were scattered over the head, rings, and feet. Every batch or brood attacked perished. Fresh eggs were imported from abroad, and at first those hatched well—so much so, that the year 1853, when a large quantity of these foreign worms were reared, was estimated as one of the most productive of the century, 130,000,000 francs being derived as revenue from the cocoons. But the following year the eggs from these worms were found to be no better than the French eggs—they were also infected. To add to the misfortune, malady extended to Spain and Italy, then to Greece and Turkey, until, in 1864, all the cultivations from every part of Europe were either diseased or suspected of being so; and throughout the extreme East, Japan only was exempt. The plague had followed the trade in silkworm eggs, just as cattle diseases have followed the trade in cattle.

In 1865, the weight of cocoons had fallen so low, that the French revenue sustained a loss of 100,000,000 francs, and the silk-cultivating Departments were in despair. Agricultural and scientific societies, municipal bodies and Governments, were all seriously engaged in attempting to discover the cause and a remedy. And there was no lack of hypotheses, suggestions, and cures; while scores of pamphlets upon the malady were published every year, and experiments were undertaken to elucidate the mysterious scourge, and limit its ravages.

The disease was known as "pebrine," owing to the peppered appearance of the skin of diseased worms.

In 1865, in response to a petition signed by 3600 mayors, municipal councillors, and capitalists of the severely-visited Departments, the French Government appointed a Commission to investigate the malady, and Dumas was selected as its Chairman or reporter, because of his great scientific reputation and his personal interest in one of the afflicted Departments. While preparing his report it occurred to him that Pasteur was the man best fitted to carry out investigations as to the mersures required to combat the plague. But Pasteur at first declined to undertake such a heavy task, inasmuch as his success in the enquiry into organised ferments, in their relation to the manufacture of vinegar and disease of wines had opened prospects of a prosperous career—in fact, it was at the moment when, disposing of the vexed question of spontaneous generation, the "infinitely little" had become to him and to science, the "infinitely great." He saw living ferments everywhere, either as the active agents in decomposition or in producing contagious disorders. To forsake a course which he had so fruitfully pursued and made his own, with all its prospective advantages, and to enter upon another which was novel to him, and the determination of which might be the reverse of satisfactory, appeared to be too much of a sacrifice. Dumas appealed to his friendship and his patriotism. "But consider," said Pasteur, "that I have never handled a silkworm." "So much the better," replied Dumas,

"If you knew nothing about the sub ject, you will have no other ideas than those which you will derive from your own observations."

CROP AND WEATHER REPORTS.

For the week ending 1st September 1886.

General Remarks.—Rain has again been general during the week, though the quantities reported to have fallen in the Madras and Bombay Presidencies are as a rule small. Heavier falls have occured in Bengal and the North-Western Provinces and Oudh. No report has been received from British Burma.

In Bombay, Madras, Mysore, and Coorg agricultural prospects continue good. In the North-Western Provinces and Oudh the recent rainfall has been very qeneficial, and the crops promise well. Prospects in the Punjab are satisfactory, though more rain is wanted in some districts.

Prospects are favourable in most parts of the Central Provinces, though rain is very urgently needed in the Raipur, Bilaspur, and Sambalpur districts. In some tracts the rain which fell during the week under report is believed to have been beneficial.

In Berar, Central India, and Rajuptana the crops are doing well.

Except in parts of Behar and East Bengal, where much injury has been caused by excessive rain, agricultuarl prospects are favourable in the Lower Provinces. Transplanting is nearly finished, and the early rice and jute harvests are in progress.

In the Sylhet and Cachar districts of Assam the crops have suffered greatly from floods, and some injury has also been done in the Lakhimpur district.

The public health is on the whole satisfactory, though fever is reported from most provinces.

Prices are generally steady.

For the week ending 5th September 1886.

General Remarks.—Rain in varying quantities has fallen generally throughout the country with the exception of Sind, the greater portion of the Punjab, and Rajputana and Berar. In Bengal and Assam the falls have again been heavy, and rain threatens to be excessive in some places in the North-Western Provinces and Oudh.

Agricultural prospects continue generally favourable in Madras, Mysore, and Coorg, though in the second-named Province more rain would be beneficial for the crop in one or two districts. In Berar, Hyderabad, Central India, and Rajputana the standing crops are generally in good condition, and prospects are favourable. The 'kharif' crop is generally in good condition in Bombay, but more rain is still wanted in most districts.

In the North-Western Provinces and Oudh the condition of the standing crops is generally excellent, and is fairly good in the Central Provinces, with the exception of the rice crop, which has suffered everywhere on high lands owing to a deficiency of rain. In Bilaspur the situation is unpromising and rain is badly wanted. In the Punjab the harvest prospects are fair, but rain is still wanted in several districts.

In Bengal, where there has been much heavy rain, a break is wanted to facilitate the harvesting of early crops. Agricultural prospects are generally fair in Assam.

The public health continues generally good in all Provinces.

Prices are rising in some districts in the Punjab and falling in Coorg. Elsewhere they are generally steady.

For the week ending 22nd September, 1886.

General Remarcs,—The rainfall of the week under notice has been confined to Madras, parts of the Bombay, the North-Western Provinces and Oudh, Punjab, the Central Provinces, and Central India, where the showers have been generally light. In Mysore there has been general rain, and in Bengal and Assam heavy falls have again occured.

In Madras, Mysore, and Coorg there is generally no change in the situation reported last week.

In Bombay, Berar, Hyderabad, Central India, and Rajputana the 'kharif' crops continue to promise well and prospects are on the whole good. Preparations for the 'rabi' are commencing in places.

The 'kharif' harvest has begun in the North-Western Provinces and Oudh, where 'rabi' operations are also in progress in many places. In the Punjab more rain is still wanted in some districts for the 'kharif crops, otherwise prospects are generally favourable. In the Central Provinces the rain of the past week has much improved prospects, and, if there is more rain, the rice crop in Chattisgarh will, it is expected, yield from 4 to 6 annas, while other 'kharif' crops will give good outturns. In other parts of the Province, especially in the rice-growing tracts, rain is still badly wanted.

Except from injury caused by floods, the late rice in Bengal promises generally well, but the early crops in flooded tracts in Behar and Tipperah have been much damaged. Excessive rain in places has interfered with harvest operations. Transplanting operations are in progress in Assam, where agricultural prospects are generally fair.

No report has been received from British Burma for the week under notice

The public health is generally good in all Provinces.

Prices show a tendency to fall in the North-Western Provinces and Oudh and are rising in some districts of the Punjab. Elsewhere they remain generally stationary

o Goalpara, Kamrup, and Darrang. The trade between Assam and the Towang Tibetans (commonly but improperly called Bhutias by the Assamese) is confined to the Districts of Darrang. They occupy the Towang or Mon Tul province of Tibet, which thrusts itself in as a wedge between Bhutan and the Aka country, and is the only part of Tibet that is actually contiguous to British India. The traders come down mainly through the Dhansiri pass to the Udalguri fair. The duties levied on traders by this route are not heavy. At the commencement of the cold weather, the Gel'engs (Tibetan revenue officers) establish a post at Amritol, seven miles beyond British territory. Each person, male and female, before leaving the hills, is obliged to give a small measure of salt, and, when returning from the plains, a measure of rice (about two seers), some betel-nuts, dried fish, and other articles of food. These commodities are carried off for their own use by the Gellengs to their residence in the higher hills at Taklung Jong or Towang.

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SIRSA CATTLE FAIR.—An important cattle fair was held at Sirsa, Punjab, between the 15th ultimo and 15th instant, at which upwards of 40,000 oxen and 1,000 buffaloes were shown. Of the oxen, however, scarcely one was deemed equal to heavy artillery work, and only about a dozen pairs were fit for Commissariat purposes. There were 320 milch cows of superior breeds, principally of English origin. At a ploughing match held during the Fair, eight ploughs did excellent work, making clean furrows some four inches in depth, and completing their tasks rapidly. This form of competition is an excellent means of improving the country breed of oxen; as only good bullock, in good coddition, can hope to win a match in which time counts for a good proportion of the marks given. This Fair appears to be held at a very hot season of the year and to last an inordinately long time. The prizes were, we understand, distributed on the 2nd instant, and before that day many men and animals had already left the Fair; nevertheless the gathering was not over until the 13th. Perhaps a later date of beginning the Fair might be advisable, as the sun shines very straight down upon the sandy plains of Sirsa in the month of August, and is not good for man or beasts.—*C and M Gazette.*

RAINS IN BENGAL.—The recent heavy rains in Bengal have been more destructive than is commonly supposed. There is likely to be a good deal of loss in the *amun* rice in Nadya. In Bogra some damage has been done to the crops on the low lands of Sherpur and Dhunat. In Sirajganj a good deal of jute is reported to have been damaged by the continued high floods and heavy rains. In some parts great difficulty is felt in transplanting the *amun* rice owing to the depth of the water. In Darjiling the excessive rain has almost destroyed the potato crop. In the Dacca district, the paddy crop has, to some extent, been damaged by the floods, but, on the whole, the crops are looking well. Some damage has also been done to the rice seedlings by the floods in the parts of Backerganj, and in Maimensing it is said that the prospects of the rice crop depend very much on how soon the floods go down. In Tippera the *aus* crop which has been lately reaped, is damaged to such an extent by the continuous heavy rains that considerable portion of it has rotted in the fields and after being stored.

THE SUPPLY OF RICE.—There is some fear of a falling off in the imports of rice into Europe. The crops of Japan and Java are unimportant. China is an importing country; so of late has the United States become, and consequently Europe is dependent upon India, and chiefly upon Burma, for its supplies. Now, it is known that the last crop was poor in quality and deficient in quantity, and as there is always a good demand for China for any rice not exported to Europe, it is believed that the stock in Burma was not larger than usual at the harvesting of the last crop. It is alleged that in Burma there is never a holding over of large stocks. What is not sent to Europe is always bought up for some country. Consequently it is believed that at the beginning of the exporting season, there was no extraordinary old stock, while the new crop was, as we have said, deficient and poor in quality. Up to the present time, the exports to Europe have been 605,600 tons, against 604 300 tons in the corresponding period of last year, being an increase of 1,300 tons. The exports to foreign countries have been this year 222,00 tons, and in the corresponding period of last year 183,470, being an increase of 38,530 tons, showing a total increase in the exports of 39,830 tons. It is consequently expected that the supply now available for shipment is smaller than usual, that there will be a considerable falling off in consequence in the remainder of the year, and that this will lead to a rise in price. Whether the rise will come off or not will largely depend upon the state of the market, and much more upon the production of other crops. If there should be, for instance, a failure of the potato crop in Germany, there would undoubtedly be a considerable

rise. On the other hand, if the potato crop in Germany is good, there is not much probability of a material rise.

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Silo Experiments in the North-West.—Besides the extensive silo experiments in the Cawnpore Agricultural Station, there were 3 pits in Sitapur, 3 pits in Lalitpur, and 3 pits in Meerut demonstration Farm, in all of which the results though not satisfactory are by no means hopeless. In the Cawnpore Agricultural Station, the fodders experimented with were guinea grass, juar chari (before seeding), juar stalks (after seeding), and the wild grasses of the rains. Two pits were taken for filling with wild grasses. The first was filled on the 16th August with 59½ maunds of the first cut of grass in fine weather; and the second on the 16th September was filled in rainy weather with 60½ maunds of grass. Both silos were protected by roofing, and were opened on the 16th April in the presence of the members of the North-Western Provinces Agricultural Association. The contents were found well preserved, and were duly fed off to the farm cattle. No better opportunity could have been afforded of publicly demonstrating the value of the system than occurred on that occasion. As to juar chari for ensilage, the term experiment is no longer applicable. It is clearly established that, either cut before seeding or cut after seeding, the stalks of juar, if chaffed, can be, ensilaged with very great advantage. In regard to grass, the difficulties are greater. Unless chaffing be resorted to, the packing of a grass silo requires skilful supervision to ensure anything like a high average of good silage when the pits are opened, or to ensure a minimum of offensive odour. It will be seen that it was only at the Cawnpore Station that thoroughly satisfactory results were obtained with grass; but even then the opinion may be offered that, so long as juar stalks can be procured, it will pay better to spend such money as may be available on ensilaging them rather than on grass. The item of cost may be examined. From the figures given, it was as follows on the quantity realised.—

	1	2	3	4
	Construction of pits.	Purchasing or cutting grass and filling.	Maunds of ensilage per rupee on (2)	Maunds of ensilage per rupee on (1) and (2), assuming the pit and the shed to last for 5 years.
[illegible]	Rs. A. P.	Rs. A. P.	Mds.	Mds.
	4 0 0	17 0 0	10	9¼
Meerut	5 9 0	12 0 0	7	6½
Cawnpore	16 5 0	10 6 0	20	8

The above is a rough calculation. The cost under (1) would recur about every fifth year. No estimate can be framed of the value of the ensilage at the time of opening the pits, as that of course would depend on a varying market. The greatest value in ensilage, in the opinion of the English Ensilage Commission, lies in its capacity for storage against times of scarcity. One of the most important remarks made by the Director is that the best time for cutting the fodder is just before it enters the stage of maturity; and therefore that, even with the wild grasses of the rains, it would be better to confine operations to one cutting just before the grasses ripen instead of taking successive cuttings.

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Government Cinchona Plantation and Cinchona Factory in Bengal.—The most important feature of last year's operations was that the planting was entirely confined to yellow bark trees, no red bark having been put out anywhere. One hundred and eighty-seven thousand plants of the hybrid variety, and 239,000 of *Calisaya Ledgeriana*, were planted out. There are now over five millions of trees of various ages in the plantation. The crop of the year was not large, having amounted to 205,410 lbs. of dry bark, of which 181,280 lbs. were red, 15 950 lbs. were *Calisaya*, and 8,180 lbs. were hybrid bark. The bulk of the crop was as usual made over to the febrifuge factory. The expenditure on the plantation amounted to Rs. 79,728-2, against the budget allotment of Rs. 97,805. Of this, Rs. 12,052-9-9 represents the capital expenditure on the young trans-Teesta plantation at Rungjung, which has not yet come into bearing; and the balance Rs. 67,675-8-3 he working expenses of the old plantations at Mungpoo, including Rungbee and Sittong. The capital account is thus brought up to Rs. 10,96.255; but, as has been explained in previous years, this has been recouped by the saving effected by the substitution of cinchona febrifuge for quinine in Government institution. The demand for the febrifuge was considerably less than in previous years. The out-turn from the factory, which is regulated by the demand, accordingly fell from 6,464 lbs. in 1884-85 to 4,743 lbs, during 1884-86—namely, 4,625 lbs. of ordinary and 118 lbs. of crystalline febrifuge. Certain improvements devised in the method of working the factory, and the introduction of grinding machinery, have raised the percentage of febrifuge obtained from the bark to three per cent. The cost of manufacture, however, rose to Rs. 12-11-2 per pound of ordinary febrifuge, and Rs. 19-0-9 per pound of crystaline febrifuge. The rates exceed those of the preceding year by five annas per pound in the case of the former, and by

eight annas per pound in the case of the latter. This was entirely due to the smaller quantity manufactured The decrease in the sale of febrifuge to the public is due to the extremely low price (Rs. 2-1 per ounce) at which quinine was obtained in the market during the year. It is, however, anticipated that the depression in the price of quinine, which is due to special causes, will not last. The revenue derived from the sale of the febrifuge, seed, plants and bark amounted to Rs. 98 225 2 in the previous year. The actual profit exhibited on the year's working amounts to Rs. 30,920-15-2. Dr. King the Superintendent of the Plantation and Factory, points out that in addition to this should be taken into account the 2 054 lbs. of febrifuge supplied to the Government medical institutions in substitution for quinine, the value of which, at the most moderate calculation, amounts to Rs. 33,000.

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A REMEDY FOR WHITE ANTS.—Mr. L. Loitard writes:—"Some of my Rose plants were attacked by White Ants a month or so ago, although *Firminger* says that these pests do not attack live plants. I have read of several specifics against white ants, but tried one of my own which was accessible at the time. I took a supply of leaves from a Neem (*Melia azadirachta*) tree in my garden and buried a few handfuls round each Rose plant, about a couple of inches below the surface, close round the stem; the white ants disappeared, as if by magic, and I have since been free of them. I do not know if anybody ever tried *Neem* leaves before, but they are really very efficacious, and, of course, they from a vegetable mould when they decay."

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COTTON GIN.—At the suggestion of their Calcutta Agent, Mr. Hugh C. Robertson, Messrs. Sinclair, Hamilton & Co., of St. Helen's Place, London, sent to the Agri-horticultural Society a 13-Saw Emery's Patent Cotton Gin, a trial of which will be made soon with ordinary cotton as well as with free cotton which, under the made of Kapok, is becoming an article of some importance; in a valuable note in Buchanan's Monthly Register published in Melbourne, on Kapok, complaints are made as to the very dirty condition of the Indian article as compared with that from Java. It is probable, that the Indian Kapok is mostly Simul Cotton (*Bombax malabaricum*), while as shown in the Proceedings for April, that from Java is the produce of the *Eriodendron aufractuosum*. The Gin may also be tried for cleaning Madàr flos.

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INDIGO.—I have experimented with twenty eight different processes, one of which was better than the others, for testing indigo; but I do not intend to describe them, only the one, which I ordinarily employ, and which gives unfailing results. Every indigo test must be subjected to two different processes; the object of the first is to establish the percentage of the indigotin contained in it; the second is for the purpose of determining the behaviour of the colour and tone. This behaviour is not, however, proportional to the percentage of the indigotin. It is necessary to have pure indigotin as standard sample, in order to determine the indigotin contained in the sample under test. In order to obtain this, take from the copperas vat the "bloom," wash it first with dilute muriatic acid, next with diluted water, and dry the residue of these washings in a stove. One gram of this indigotin and one gram of the indigo to be tested are dissolved, each in 20 cubic centimetres of Nordhausen sulphuric acid. Solution takes place in 24 hours, and it is then increased to one litre by the addition of distilled water; 10 cubic centimetres of the solution are taken and decolourised with freshly prepared chloride of lime solution of from 1 to 10 B. By comparing the quantities of the chloride of lime necessary for decolouring the two solutions, the degree of percentage of indigotin is ascertained. In order to ascertain the dying power and tone make a small warm zinc-vat prepared with:—Indigo 1 gram; zinc powder 1 gram; bisulphate of soda of 30 B., 10 cubic centimetres; 20 per cent. milk of lime, 10 cubic centimetres. This vat is heated slowly, 1 litre of lukewarm water is added, and two samples of wool, each of 25 grams, are one after the other dyed in it; one light blue, the other dark blue. By comparing them with one or two other samples, dyed with a standard indigo, it is easy to arrive at definite conclusions as to the value of the indigo under test. This suffices fully for practical tests, which is the main point. From a Corresgondent of Treinteur Zeitung.

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RAIL-BORNE TRADE OF THE PUNJAB FOR THE QUARTER ENDING 31ST MARCH, 1886.—Imports of European cotton piece-goods, copper, iron and exports of wheat and sugar have fallen off; while there has been an increase in the import of Indian piece-goods and sugar, and in the export of rape and mustard seed. The increased exports of rape and mustard seed went almost entirely to Bombay Port. There was also a considerably increased export of wheat to Bombay Port and the North-West Provinces but this was much more than counterbalanced by the diminished export to Karachi. There was a large export of gram to Howrah, but exports of gram to the North-West provinces fell off. It is noticeable that the decrease

in imports of European cotton piece-goods and iron occurred almost entirely in imports from Karachi. On the whole, the Karachi trade seems to have suffered during the quarter at the expense of that of Bombay Port, Howrah and the North-West Provinces.

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INDIAN TEA.—The *Grocer* says with reference to Indian tea.—The estimates of the tea crop for 8886, prepared by the General Committee of the Indian Tea Association a few months since, showed that there was likely to be a yield of nearly 76,000 000lbs., as compared with 68,735,000lbs. actually produced in 1885. This represents an increase of over 7 000,000lbs. for the seasons now commenced, and means a very considerable addition to the existing supply. According to advices from Calcutta, the exports from that place to Great Britain during July amounted to 6,096,000lbs., against 5,859,500lbs. last year, and 5,180,500lbs. in the same period of 1884. In London the stock of Indian or Assam tea at the end of August was materially heavier than that in 1885, embracing 12,771,600lbs., in contrast with 10,439,800lbs. in the previous year; the landings during the eight months having reached 30,765,600lbs. in lieu of 26,931,600 lbs. in 1885. The deliveries alone seem to have stood still or gone back, and for the present year to the 31st ultimo did not exceed 42 633,700lbs., in comparison with 43,760,100lbs. in the former season.

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CIRENCESTER SCHOLARS.—In our last issue we made the following remarks. "Mr. A. C. Sen, now of the Bengal Agricultural Department, had scored the highest number of marks and Mr. Mukherji has surpassed him." We have been corrected by a friend of ours. We were wrong in stating "Mr. Mukherji has surpassed him (Mr. Sen)." Notwithstanding high marks obtained by Mr. Mukherji, Mr. Sen is still ahead of him by a few marks.

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COAXA. Coaxa in the North-West is the same as *Bokra* in Bengal, and the cause is destruction, from decomposition, of the cohesive matter in the indigo, principally during drying. Defective pressing, where the excess water has not been extracted, will cause *Coaxa*:—there is an excess of moisture in the cakes,—they are longer drying, and fermentation goes on to a great extent; much more so than in a well pressed slab. A damp dark drying house will also conduce to the after-fermentation in the cakes; for the indigo is longer moist than in a well lighted and ventilated drying house. Defective boiling, too, conduces, in a great measure, to after-fermentation. The most general cause of *Coaxa* is defective boiling, and defective pressing.—*I. P. Gazette.*

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RUTHERFORD MEMORIAL.—To the students of the Cirencester Royal Agricultural College who are in India and who subscribed to the fund raised to suitably commemorate the departure from the Royal Agricultural College of Mr. Rutherford who for a long time honourably filled the post of farm bailiff, to the satisfaction of professors and students alike, it will be a great satisfaction to learn that the silver cup presented to him by his Indian students was immensely liked by him. It was in silver ornamented with raised work, showing shikar scenes. On one side, the R. A. C. arms were shown with the inscription "To Robert Rutherford. From old students in India, 1885."

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FLAX LAND.—The best land for growing flax is a good heavy land in a cool clay subsoil. Rich old lea, after producing a crop of oats, gives excellent flax without manure; but flax does well after a crop of oats, barley, or wheat, which has been grown in land manured for potatoes or turnips the preceeding year. Land for growing flax should be ploughed in small furrows, and not deep. If the land is of a fertile nature and ploughed early, it should not be ploughed a second time; but if the land be stiff, it is best to plough twice and harrow and roll alternately until it is pulverised. This can be done only in dry weather. The ground must be dry before the seed is sown; when sown it is covered with a chain or seed harrow; two bushels to the imperial acre is the quantity of seed usually sown in Ireland. Riga seed is badly saved this season, and Dutch seed only should be sown. The proper time for sowing is from the 20th April till 1st May. If sown earlier the braird is often damaged seriously by frost. Manures of any kind force the crop to grow to straw without fibre, and should not be applied. The only thing useful to flax is a little coarse salt, about 6 cwt. to the imperial acre, and, when applied, is sown two weeks before the flax seed. The ground should get one stroke of the harrow after the salt is sown broadcast. Flax crop requires no after cultivation, but hand-weeding by women when it is four to six inches long. Weeding should be done in showery weather. The trampling of the women is not hurtful to the crop. It is ready for pulling when about two-thirds of the stalk gets stripped of leaves and becomes yellow. The pulling is done here from the 1st to the 12th August. Straps made from the flax, like oats, will not answer; rushes cut and cured like hay are used here, and are plentiful and cheap, and could be supplied to Scotch farmers at a low price.—RICHARDS AND CO., Aberdeen.

AGRICULTURAL STOCK.

BULLOCKS, bulls, and buffaloes are the only beasts used for ploughing throughout India, excepting in Sind and the Western districts of the Punjab. The general condition of these cattle is miserably poor, owing partly to insufficiency of grazing land, partly to neglect of the principles of breeding and partly to want of Veterinary knowledge. With increase of the area of cultivation and consequent diminution of waste land which in India means grazing ground, the prospects of these poor beasts are becoming every day worse. Preservation of forests from reckless destruction, reclaiming of waste lands, fostering the growth of plantations, and introduction of fodder crops in the regular course of agriculture, seem to be the only means to check the deterioration of our ploughing beasts and ultimately to improve them.

There are however a few local breeds which are used in works other than agriculture and therefore carefully fostered. The *amrit mahal* is a breed of cattle in Mysore kept up by the local authorities for military purposes. The indigenous breed of Nellore and Karnul in Madras has lately been greatly improved. There is a high-class breed of trotting bullocks in the Central Provinces, in great demand for wheeled carriages. The large breeds of oxen of Guzerat in Bombay and of Hariana in the Punjab are very well adapted for drawing heavy loads in a sandy soil. The bulls of the Government Farm at Hisar in the Punjab are also very well-known. The worst cattle are to be found in the regions of delta and here their place is partly taken by buffaloes which are more hardy than ordinary cattle though not so easily manageable. In lower Burma, the plough cattle are bullocks and buffaloes almost half and half. Along the Indus Valley and in the sandy desert which stretches into Rajputana camels supersede cattle for all agricultural operations.

Indigenous breeds of horses speaking broadly do not exist in Bengal and Madras. In Bombay the chief breeds are those of the Deccan and of Kathiawar. The Punjab, however, is the chief source of remounts for the native cavalry attached to the British military. The district of Jhang is especially famous for its horses. The mares are believed to be the best in the Punjab. A horse fair is annually held there and prizes distributed. An enormous number of different breeds of horses is recognized among themselves by the zemindars of the district. The following are the names of the breeds with the names of their Breeder attached against each:—

Name of breed,	Name of breeders.
1. Harsian ...	... Mahomed Khan and others, Beloches of Ghatta.
2. Phabhanan ...	... Bharwanas of Khiva and Mukhiana.
3. Kajlan ...	... Syuds of Batta Matta
4. Ghararian ...	... Do Do Kot Isa Shah.
5. Matwalian ...	... Liwanas of Rajana.
6. Mornian ...	... Sylas of Ahmadpur.
7. Jiwanian ...	... Alianas of Kot Khan.

This district being specially reputed for its horses, a few points about their breeding and management as practised in the district are likely to be of interest to our readers.

According to the opinion of the people of the country, a mare ought not to be put to a horse before it is 3½ years old and there are two proper seasons for it, namely, one in March-April (chait-Baisakh) and the other in September-October (Assin-Kartic). The foal lives on the dams milk alone for the first month only. In the second other milk is given in addition. Camel's milk is preferred for this addition and in its absence cows or goats milk is given. The milk is sweetened with sugar and, beginning in small quantities, is raised to as much as five or six seers a day. The foal is weaned from the mare when six months old but the additional milk is continued to be given for four to six months longer. Gram soaked in milk is also given. Colts are allowed to run loose in the young wheat and also given jowari and pulse known locally as moth.

Breaking in commences when they are two years old. They are first ridden bare back. A horse in this district is considered to be in full working order up to the age of 12 or 13 and to deteriorate afterwards. A mare will go on producing foal till she is 15 years old. Horses are fed in the following manner. Green wheat—from 15th December to 31st March; bhusa, grass and grain—1st April to 31st June; grass and grain—1st July to 31st August Indian corn cobs, jowari, and bajri heads and stalks—1st September to 15th November; and Missa bhusa and jowari—15 November to 15th December.

Every breeder of horses sows early half or a quarter of an acre with wheat or mixed wheat and barley to afford green food at an early date for his horses. A good deal of importance is attached to this point. Gram is given regularly by wealthy men, but, as a rule, ordinary zemindars only give it when they can

not get green food or fodder. It is not given as a matter of course. To get horse in splendid condition, they are stalled in a dark shed with green wheat up to their hocks, in much the same way as cows are put to fat in boxes in England. Boiled *moth* and *mash* mixed with molasses and turmeric is also given. It takes about 30 days for a horse to come out quite fat when it is unfit for any work whatever.

The colors in this district are dark bay chestnut, light bay, grey, white, roan, piebald, and black. A horse's color ought always to be bright. Among the unlucky spots on a horse are *tara pashani*, a small white star or blaze on the forehead; *argal*, two legs or one different in color from the rest of the body; *baurian*, rough spots on the coat especially if near the tail; *nagarian*, a line of rough hair on the neck, pointing backwards; and *garara*, eyes of different color.

WOOLLEN MANUFACTURES OF THE PUNJAB.

THE Punjab has been the home of Wool-Weaving from very remote times. Sheep and goats are therefore the most useful stock of the Province. Wool-weaving by steam machinery has no doubt recently been established in India, the principal mills being the Egerton Mills in Gurdaspur district, Punjab, and the Cawnpore Woollen Mills in the North-Western Provinces. But Wool-weaving more than cotton weaving is still essential by a domestic industry. A monograph recently published by the Punjab Government on the woollen manufactures of the Province in 1884-85 is full of valuable information on the subject and very interesting reading. The raw materials to be considered are four in number,—(1) sheep's wool, (2) pashm or wool of the Thibetan shawl goat, (3) Goat's hair and (4) Camel's hair. Pashm is not grown in the Province at all, except to an inconsiderable amount in Spiti. The wool worked up in the Province is mostly locally grown, the principal wool-growing districts being Hissar, Ferozpur, Lahore, Jhang, Shahpur, Peshwar, Dera Ismail Khan, Amritsar, Mooltan, Rawalpindi, and Jhelum. During 1884 the total produce of wool of the Province is put down at 82,000 maunds.

The staple varies both in color and length. In the plains black seems to be almost as common as white, while in the hills, the sheep may be black, white, bluish brown, reddish brown or grey. The length varies from 2 inches in common breeds to six or even more in the case of hill-breeds. Probably the finest wool in the hills is the Lahauli wool, of four to five inches in length; but even this is said by the manager of the Egerton Woollen Mills to be inferior to Australian wool. The long hill wool, however, takes dye badly.

In the production of goat's hair the Mooltan district in pre-eminent; and then come Shahpur, Gujrat and Dera Ghazi Khan. The total for the province is about 9,000 maunds during 1884-85. Camels seem to be sheared chiefly in Shahpur and Hissar and Dera Ghazi Khan. The total produce of the province is not more than 2,400 maunds.

Sheep shearing is done twice a year, in spring and autumn, except in Hissar, Kangra and Kulu, where there is an intermediate shearing in June; and the usual wages is one-twentieth of the wool shorn. A man can shear 20 unwashed or 25 washed sheep *per diem*. In most districts the sheep are washed before shearing, but generally with cold water and in a superficial way; but only in the case of the fine sheep of the Mansehra tahsil of the Abbottabad district is it stated that the want of washing before shearing is detrimental. Shearing is done with scissors 8 inches or more in length, and in some places with shears. The weight of fleece varies from three chittaks' in the case of the inferior plains sheep, to one seer in Kangra hill-sheep. As these Kangra sheep are shorn three times, it may be taken that three seers is the very largest annual yield from any sheep in the province. Excluding Kangra and Kulu sheep, the annual yield cannot exceed one seer *per* sheep, and the quality also is inferior, while average English sheep certainly give as much as five pounds and some breeds even nine pounds.

The clipping of goats is done once a year in nearly every district, and the yield is about half a seer at a clipping. Camels are clipped once a year. The yield at each clipping is one to two pounds for a male and two to four for a female, the cause of the difference being that the back and shoulders of the male camel are never clipped. Each sheep's fleece when cut is made up into a bundle and in this state sells at an average rate of 2½ seers per rupee. The average price of goat's hair is about 13 seers per rupee; and of camel's hair 5 seers. The *pashm* imported is worth one rupee and eight annas a seer on an average and *Wahab Shahi pashm* (so called) about 12 annas a seer.

To make it fit for spinning, the wool is first sorted, then washed, hand picked, and carded or combed,

Sorting is done in a very primitive style, washing is not common, nor is it necessary except for wool loaded with sticky matter, and picking out of foreign bodies by hand is done everywhere. Carding is done by *pinjan* (bow string), an instrument which is very commonly used for all over India for carding cotton. When the spinning of worsted is wanted, combs are used which not only open out the wool but also lay the fibres side by side in parallel lines. In some districts as Jhang, Jullunder, and Ludhiana carding or combing is not usually done, the wool is simply teased by hand to a homogeneous mass of fluff. The wool when teased, or carded or combed as the case may be, is made up into balls called *punis*.

The next operation is spinning, which is done either by an instrument called *Charkhi* (charka) or an instrument still more crude called *dherna* or *takli* (dhera).

In the hills spinning is done by all classes, both sexes, and all ages from ten years and upwards. In Kulu, for instance, every tenth person one meets on the road is spinning wool with a *takli* as he or she walks along; and it is no doubt the portability of the instrument as much as anything else that causes it to be used instead of the *charkhi*. In the plains, while women of all the poorer classes spin wool in their leisure moments for blankets, &c., to be made for the household, we do find here and there classes of persons who do spinning regularly for pay. When yarn has been spun, it is generally found that it is too thin at places to bear the strain of weaving. The yarn has therefore to be doubled or trebled, and sometimes more than three folds are given. For twisting, as this process is called, the *charkhi* can be used and also a form (called *masan*) of the *dherna* or *takli*. Yarn, single or double, is sold in balls (in the hills) or on reels (natai) of various shapes; but before weaving it must be wound on reels and the warp (*tana*) prepared.

When the warp has been laid, it is removed from the sticks for sizing, which is done by immersing it in a starch of wheat flour and then stretching it between trestles to dry, the superficial residue of the starch being brushed off when dry by a brush of *khas khas* grass. "Pan" and hemp water are also used for sizing. In some parts sizing is not done at all, *e. g.*, in Kulu and Hazara. The stuff is now ready for the weaver.

The loom that is used for weaving is in its essentials much the same as the hand looms used in other countries. In Kangra the weaver gets three to four annas for a day's work. It may be doubted whether there is any distinct average steady work for the weaver at this rate. Weavers are in most places a distinct caste (*Julaha*), but it is said that in Hissar *chamars* and *dhanaks* also weave wool.

The cloth after weaving is rough and threadbare in appearance and it has now to be felted. This is done by immersing it in water in which has been made a lather of soap or ritha (*sapindus detergens*), and kneading the cloth with the hands or feet. If the cloth is then pegged out to dry, shrinking is avoided: if not pegged out, it shrinks considerably. Whether pegged out or not, the surface becomes uniform and the separate threads are either not distinguishable at all or very little so. If the cloth has been made out of real worsted yarn no felting is attempted: such yarn is used when cloth like serge is made in which the threads are to remain visible; but such cloths of country make are uncommon. In all cases, too, washing after weaving has to be done to clean the cloth.

Finally, in some districts and specially in Kulu, a stiff brush (*thakaru*) is used to raise the nap. The bristles are made of small slivers of cane, which serve the purpose fairly well but are inferior in the requisite horny elasticity to the teazle (*dipsacus fullorum*), a plant that has been grown with success by a settler in Kulu and which could easily be grown anywhere in the Himalayas at moderate altitudes.

For articles made out of unspun wool, the general name is *namda* or felt, and they are used for bed and floor rugs, for horse cloths, for lining ice boxes, and for other purposes. Though the details of manufacture differ, the principle is everywhere the same. The wool is scutched or hand-teased and washed. A layer of it is then spread out over a mat that can be rolled up like a door-chick. The thickness of the layer depends on the thickness of the namda wanted, and to produce a good article the thickness must be uniform. Then water is sprinkled well over the wool and the mat carefully rolled up and subjected to pressure by the feet or hands and kneaded for a period varying from one to three hours. In some cases this finishes the process; but sometimes the mat is opened and the namda turned upside down and the process repeated. In very many districts, too, mere sprinkling of water is not deemed sufficient: the natural felting property of the wool being small, the wool has to be soaked in a solution of soap, which, drying, causes its fibres mutually to adhere; and in one district, viz., Delhi, a mixture of chalk and gum has to be added.

It is clear that the best namda must be those which are made from wool which felts merely with water, and that the use of any viscous substance

to produce this effect is a sign that the wool is not really fit for namda-making. It stands to reason that a namda depending for its compactness on any substance soluble in water is at the mercy of the first heavy shower of rain or of the first more than momentary immersion in water. Ritha lather, used in some places, is not objectionable, as it assists real felting and is not sticky.

Namdas are made of a single colour and also in patterns some of which are very pretty. As a *namda* is never intended to be washed, the dyes used in the pattern are seldom fast; for the use of a fixing ingredient would be an unnecessary expenditure. To make a *namda* with pattern, the pattern is first laid out on the mat and the ground work wool is spread over it; or the ground-work is spread out first. The patterns are sometimes geometrical, but sometimes contain conventional art foliage and flowers. *Namda*-makers are not *Julahas*, but belong to different castes. In Hazara "telis" do the work. The usual wages are two to three annas *per diem*.

Woollen carpets are made also in the Kasur tahsil of Lahore, in Amritsar, and in a few other places. In the Kohat, and to a small extent in the Bannu district, a carpet or rug called *nakhai* is made. In weaving this, after a weft thread is put in, the portion between each pair of consecutive warp threads is pulled upwards an inch and so left. These loops are not cut when the rug is finished so that the nap consists of a mass of loops. Small rugs used as seats and called *asans* are made in Shahpur, Ludhiana, Lahore, Hoshiarpur, and other districts.

The *Lois* (लूई) of Sirsa and Fattahabad in the Hissar district and of Ludhiana are fine in texture and warm, while those of most of the Punjab districts have no special excellence.

There is no essential difference between *loi* and *bhura* and *kammal* (कम्मल). *Lois* seem generally to be made white and *kammals* black (dyed or natural); while *bhuras* are much the same as *lois*, and the two words may be taken almost to be synonyms. There is also no essential difference between the texture of *alwan* and that of *loi*. *Alwan* is cloth in long pieces for cutting up by the tailor; a *loi* may be of exactly the same make, but it has some sort of edging, *e. g.*, a single coloured line, and is for use as a blanket. In the Hissar district *dhabla* is made, cotton and wool being mixed in the manufacture. A similar manufacture elsewhere is called *garbi* (or *garvi*) *patti*.

Pashm is the product not of a sheep but of the Thibetan shawl-goat which has two distinct hairy growths—ordinary hair, and mixed with it, pashm. Generally speaking the hair and pashm are imported mixed, and the separating of the hair is done by women, and is a very tedious process, a woman's work being one chittak a day and her wages one to two annas. The pashm then after combing is bleached by steeping it in rice-flour and water and putting it out to dry in thin flat leaves. When dry it is made into small balls and is ready for spinning and is spun as wool is spun. In the Kangra district the threads are made of a uniform length of 1½ yards and each piece is called a *dhaga*.

The chief fabrics made of pashm are shawls, Rampur chadars, *pashmina alwan* ("a fine white serge-like stuff," as made in Simla), *jamawars* (striped pattern, made also in wool), *rumals* and *garbi chadars*. The last-named article is comparatively modern and probably has a future before it. In it the warp is of pashm and the woof of cotton. It is much stronger than the whole-pashm chadar; It is practically as warm and nearly as soft; and in delicacy of surface and attractiveness to the eye, it may be said to surpass the older fabric. In 1880-81 the outturn of pashmina goods and of shawls was officially put at Rs. 11,04,642, and this figure may be taken to exceed somewhat the outturn for 1884-85.

The use of pashm is practically confined to the districts of Ludhiana, Simla, Kangra Proper, Amritsar, Gujrat and Lahore.

Shawls are made chiefly in Nurpur and Triloknath in Kangra, where the number of factories has fallen from 80 to 20 in the last 20 years, and in Gujrat.

The causes for the decline in the manufacture and export of shawls have been variously estimated. The author of the monograph gives the following summary. "The persons concerned put it down to the check caused by the seige of Paris by the Germans, that city being formerly the chief customer, and to a subsequent change of fashion in Europe. I am inclined to attribute the decline rather to adulteration in the manufacture, to the success of the Rampur chadar industry in England, to the want of ingenuity in the production of new and artistic designs, and to the evil effect of the hard water of Nurpur on the material used. The change of fashion is a good deal the result of these causes; and, for the miserable wages now to be got, improved work is hardly to be expected in the future."

The dyes used are mostly vegetable dyes. They are applied to the yarn or made fabric, excepting in the case of *namdas* when wool is dyed. The chief colors are the following:—

(a)—Red, made with cochineal, needs three tolas of cochineal for one yard of cloth or quarter seer of thread. The cochineal is put into boiling water in which the cloth is immersed and then sulphuric acid and saltpetre in certain proportions are added. The drying is done in the shade. If a deep red is wanted the cloth must then be put in boiling water to which four tolas of turmeric, one chittak pomegranate seeds, two chittaks of sulphuric acid and saltpetre have been added. The gulanar shade of red is made by doubling the turmeric.

(b)—A common red is also made from lac, got from the ber or kul (*Zizyphus jujuba*), the *kikar* of Sind or Bakul (*acacia arabica*), the dhak or palas (*Butea frondosa*) of Hindustan (not of the Punjab), the banyan or ashetha (*Ficus Indica*) and the pipal or Bat (*Ficus religiosa*)

(c)—Blue (*nila*) is made in many shades, the basis being indigo and the fixing material chiefly sulphuric acid. Turquois blue, (*firuza*) is made from an imported dye with alum added during the process.

(d)—Yellow is got in many ways. One concoction used contains *akalbir (Datisca cannabina)*, turmeric and alum; another *Kesu*, or the flower of the palas or dhak (*Butea frondosa*), which however gives only a transient dye. Yellow may also be got out of the rind of pomegranate (*naspal*) with some fixing substance added.

(e)—Green can be got by dyeing first for blue and then for yellow as is done in Kulu; or by adding to the concoction for blue, turmeric, *akalbir* and alum.

(f)—Black is made in many ways. In the hills, green walunt shells are used and the black colour produced is very intense and lasting. Another deep black is got from indigo added to a fermented compound of *gur*, *ata*, and the refuse after iron is smelted.

In dyeing wool such substances as sulphuric acid and lime are added merely to help the wool to absorb the colour. *Akalbir* is used with the same object.

Woollen fabrics requiring bleaching are exposed to the fumes of burning sulphur. Aniline dyes as used in the province are never fast. The *garbi chadar* (*pashmina*) can only be dyed *khaki* but is generally undyed. Dyers are generally a separate caste and they are, as compared to spinners and weavers, well off.

WHEAT CLEANING EXPERIMENT IN BOMBAY.

Our readers may remember that last year an experiment was conducted in Bombay of cleaning wheat by threshing the corn with a Steam Thresher, the report of which from the pen of Mr. Ozanne, the Director of Agriculture for Bombay, appeared in the first number of this journal. Guided by the very favourable opinion given by the Chamber of Commerce of the Hansia variety of wheat grown in the Olpad Taluka of Surat and in the Hansot and Vagra Talukas of Broach, as a wheat suitable for export, the Director decided to conduct the trials in Olpad and Hansot. There were other facts which led to this selection. The country is flat, the roads are metalled and bridged, the transport facilities by sea and rail considerable, the cattle strong, and the cultivators well-to-do and comparatively thrifty and presumably more likely to appreciate the new venture. Further he had the assurance of the Commissioner, Mr. Sheppard, that there is plenty of money in Gujrat ready to be invested in any scheme the success of which is assured, though the capitalists are very backward in speculative undertakings. It seemed therefore that he could not make better use of the sanction accorded than by demonstrating the utility of the steam thresher in Gujrat. Further he was anxious to have the trial in a spot easily accessible to the members of the Nadiad Agricultural Association and to deputies of the Chiefs of Kathiawar and of the Baroda State.

Messrs. Marshall, Sons & Co. of Gainsborough, the patentees, after consultation with the mechanic deputed by them last season to conduct the trials, resolved to modify their machinery to make it more suitable to the requirements of this country. The trial was fixed for the 15th February. It was intended to take the new machine direct from Bombay to Surat by sea and thence by road to Olpad. Numerous notices were printed and distributed throughout Gujrat, inviting visitors to witness the trials. Delay however occurred. It became evident that the new machine could not arrive in time.

To prevent disappointment the old machine of Messrs. Balmer Laurie & Co. of Calcutta, which had been worked last year, was brought down and worked for a short time at Hansot. The circumstances were anything but favourable and the results showed that this machine had better not been worked.

The new set did not arrive till the 27th March. In the interval Mr. Harper, the representative of Messrs. Marsall, Sons & Co., took the oportunity of calling on His Highness the Thakor Saheb, of

Limbdi, who evinced much interest in the project and who had seen the abortive trial at Wadhwan. He placed himself in communication also with Mr. B. A. Dalal, who, has established a large farm in the Panch Mahals. Mr. Dalal had some 500 acres of wheat. He had seen the trials at Hansot. It was arranged that thenew machine should on arrival be taken at once to the Bahadarpur Station on the Baroda State Railway which is only 6 miles from the farm. Mr. Dalal was ready to consider the question of purchasing a complete set, if the trials gave satisfaction. This plan was not carried out, because the Railway authorities refused the responsibility of carrying the machinery over the narrow gauge railway between Miagyaon and Bahadarpur. The road was inspected and pronounced very difficult. The season was late and it was therefore decided to take the machine from Bombay to the Bhadgaon Farm, where the Director was very anxious to have a trial made.

The first point worthy of notice is the great ease with which the machine and engine traversed the road to the farm from the railway. It is good for the most part, but there are two nalas with a steep gradient and the Girna river with a wide stretch of soft sand on each side of the stream. The bank too has a steep slope. This is "a proof that the machinery is capable of passing over all but the roughest deep-rutted country roads."

The Director thinks that the report of Mr. Stormont, the Superintendent of the Bhadgaon Farm, proves clearly the success of the trial. He visited the farm on the 27th April to see the modifications made on the old pattern and to convince myself of the success of the working of the straw-bruiser. He had already received Mr. Stormont's demi-official opinion. "The working of the machine is very satisfactory. The bruising of the straw satisfiies every one, and the winnowing and separating are perfect as compared with the work of the other machine" (*viz.* the old machine at Hansot where Mr. Stormont saw the trials). The only drawback or rather point of doubt was the rubbing of the grain. He believes that in dealing with wheat for export the polishing will prove advantageous rather than the reverse. Nor has he any apprehension that it can affect the germinating power of the grain. Mr. Stormont will demonstrate this by sowing some of the rubbed grain next season before as many of his neighbours as possible. The rubbing was not noticed last year at Nasik nor this year at Hansot. But the mechanic Mr. Stevenson declares that it is normal and always desired by the millers. The Director saw some soft white wheat put through the new machine. No rubbing was detected. The rubbing can be avoided, if necessary.

He is of opinion, therefore, that the results of the short trial made with the improved machine are eminently satisfactory. The straw-bruiser is a success. The machine can deal well with gram and linseed and with other crops, no doubt, not yet experimented with. Government will notice with satisfaction that Messrs. Marshall, Sons & Co. have now sent out a representative to foster the project. This gentleman, Mr. John Harper, intends to stay in India for a year at any rate. He has placed himself in communication with the Chamber of Commerce and the leading wheat merchants, judging that the success of the scheme depends on arrangements whereby clean wheat shall secure a market suited to its merits. If wheat is cleaned by machine and finds its way into the Bombay market, it will be adulterated up to the percentage allowed by the trade. It is for Messrs. Marshall, Sons & Co, to consider these points. Pecuniary assistance from Government has not been asked to carry out further experiments. But it is very essential that Government should promptly carry out the agreement already made, in other words, that the machine now on the Khandesh Farm should be purchased. Labour-saving machinery on such a farm isolated from facilities for securing manual labour is especially valuable. Mr. Stormont shows that he can utilise the engine in driving saw gins for cotton, crushing cane, pumping water for irrigation, grinding flour and sawing wood. It will be also incumbent on him to popularize the special feature, *viz.*, the wheat-threshing and winnowing. His situation in the centre of a large wheat-growing tract, the produce of which is largely exported, also will enable him to help in the introduction of machinery. Were it even certain that the machine would not pay the farm, it would be a small thing for Government to submit to a sacrifice when the ultimate results are so important.

Mr. Stormont has recorded his opinion that the wheat export of Khandesh is only second in importance to that of cotton, and that the area of wheat would largely increase if the rayat could get the produce ready for the market before the burst of the monsoon. The ill success of the cotton crop for the last 5 seasons in Khádesh, which Government is fully aware of, demands that all endeavours possible should be made to establish an alternative export crop. Wheat and cotton demand similar land. It is true, as Government has hinted, that better seasons for cotton will in all probability soon come. But the recurrence later on of a cycle of bad cotton seasons is at least as probable. In Mr. Stormont, Govern-

ment has an agent who is competent to deal with the wheat export and the opportunity of rendering his services beneficial to the public at large should not be lost. Government is aware further that the deterioration of Khandesh cotton is a fact which is thoroughly recognized, and an evil with which both Government and the representative of the trade are admittedly powerless to cope.

The Agent of the Flour Mill Company, was very anxious to have as much soft wheat threshed by the machine as possible, even before the trials this season began, for milling in Bombay, and he repeated his request on inspection of the samples. Unfortunately the wheats of Hansot and Bhadgaon are hard and not suitable for his purposes.

It will be distinctly borne in mind that, as noticed by Mr. Ozanne, the success of the scheme depends on arrangements whereby clean wheat shall secure a price suited to its merits. As long as the trade does not abolish the standard of refraction, the cleaning of wheat by the steam thresher or by any other means would be of no avail. We refer our readers to our articles on wheat trade and cultivation in the 9th and 18th number of this Journal.

TOBACCO CULTIVATION IN BURMA.

The state of tobacco cultivation in Burma during the season of 1885-86 has been reported on by Mr. Cabaniss Assistant Director of Agriculture. The disturbed state of the province interfered materially with the tobacco operations during the past season. Notwithstanding this there has been an increase in the area under cultivation and a great improvement in the quality of the tobacco produced, as is shown by the higher prices obtained for it.

Four Chinese manufactories of pipe-tobacco are at work in Rangoon, and the imports of tobacco from China, which have shown an average yearly increase for the past four years of over 9,000 lbs. per annum, show a decrease this year, 1885-86, of 14,900 lbs. less than 1884-85, and allowing that there was the usual increase in consumption of this tobacco, it shows that over 23,000 lbs. were manufactured in Burma. But the manufacturers claim to have manufactured over 50,000lbs. during the year. They say that their business is increasing and that they have sent shipments to every part of the province, and trial shipments to Penang, the Shan States, and the country north of Bhamo. The manufacturers further informed me that if they can procure tobacco shade-dried, grown from American seed of the quality produced last year at the Kanaung farm, in a short time they will not only be able to stop the importation of tobacco from China to Burma, but that they will be able to do a good export trade in tobacco. One manufacturer informed me that his last shipment of 50 packages to Penang netted him a profit of two dollars per package. A great advantage has been gained by having induced these Chinese manufacturers to visit the tobacco-growing section and buy direct from the cultivators. It is an advantage to both manufacturer and cultivator, as the profits heretofore made by middle men will be divided between producer and manufacturer. These brokerage charges have acted as a tax on tobacco production in Burma in favour of tobacco produced out of the province.

The improved Burma-grown tobacco from foreign seed is coming into competition with the imported leaf for cigar-making, but to what extent it is impossible for me to ascertain, as the cigar-makers mix it with the imported leaf. The only places that I know of where the cigars could be obtained manufactured from the pure Burma-grown leaf were Kyauktan and Ma-ubin.

The cultivation of tobacco in the Kyauktan subdivision has not increased and some of the cultivators who were growing tobacco there have removed to the kaing-lands near Zalun, where they can produce larger crops. The quality at Zalun is not so good or the prices obtained so high as for that grown at Kyauktan, but the outturn is more remunerative to the cultivator on account of his being able to produce a larger quantity.

The cultivators near the Kanaung farm, who grow tobacco from American seed and shade-dried it, were offered by cigar-makers Rs. 75 per 100 viss for it in the month of May, and as that was three times as much as they had ever before obtained for tobacco grown in that section they were advised to sell; but they refused, saying that they would hold a short time. During the month of July, I saw some of this tobacco in the Myanaung bazaar for which, Rs. 100 per 100 viss had been paid. This tobacco would be used for cigars.

I have not learned the prices obtained this season for the improved tobacco produced at Kama, but the cultivators there were much pleased with the growing crop. A Chinese manufacturer went there to purchase his leaf for manufacturing purposes.

I have also been unable to learn of any sales having been made near Akauktaung, but the cul-

tivators there were also pleased with the crop while growing, and I saw some of it that had been well shade-dried by a cultivator there.

I am informed by the Deputy Commissioner of Tharrawaddy that the cultivators at Monyo sold their improved tobacco at Rs. 50 per 100 viss; by the Settlement Officer of Henzada (Mr. Hall) that a cultivator on the island of Pyingat near Henzada sold his improved tobacco at Rs. 75 per 100 viss; by a cultivator from Zalun that he had sold a part of his crop at Rs. 65 per 100 viss, but would hold the rest until he obtained Rs. 74 per 100 viss for it.

At all the previously mentioned places, Burmese tobacco has seldom if ever sold for more than Rs. 25 per 100 viss and at present can be purchased at that price. It will thus be seen that the improved variety and method fetches from twice to four times as high prices as the indigenous variety and method of curing. Being able to sell at such high prices must act as a powerful incentive to increased production, and that it has so acted is proved by production having increased from 18,187 acres under tobacco cultivation in 1884-85 to 20,358 acres in 1885-86, an increase of 2,166acres, or 1,732,800lbs. That this increased production and improvement is already affecting importations of tobacco into Burma has already been shown in the case of Chinese tobacco. The importations of leaf-tobacco from Madras also show a decrease of 42,753lbs. this year as compared with the previous year. The importations of manufactured tobacco from Bengal and Madras also show 26,669lbs. less this year than last.

The impirtation of leaf tobacco from Bengal shows an increase this season over last season of over 4,000,000lbs.: but this is accounted for by the importations of the season of 1884-85 having been abnormally small, having been less than the season of 1883-84 by about 5,000,000lbs. and less than the average importations for the previous four years. The Customs Department reports heavy stocks of this imported tobacco on hand at the end of the year, owing to the limited demand for Upper Burma during the closing months of the year. It takes time for an improvement in agriculture to become known to cultivators, and that there will be next year a still larger percentage of increase in the area planted with tobacco I have little doubt; but with the establishment of good government in Upper Burma, the demand for tobacco will, I think, increase enormously, and unless some steps are taken to spread tobacco-cultivation to Upper Burma, this demand will, for several years, exceed the increased production in Lower Burma.

During the past season from October until May, my time has been spent almost entirely among the tobacco-cultivators of the province. The island of Shadaw in the Irrawaddy river near Kanaung was selected by me as my headquarters, it being in the centre of tobacco-cultivation and a convenient place for cultivators to visit. On this island about four acres of tobacco were grown by me and a temporary curing-house erected in which the tobacco grown by me was cured. In the first part of the season, my time was occupied in distribution the tobacco seed and afterwards in visiting some of the principal islands and churs on the river to instruct the cultivators in the proper method of drying the leaf. A large number of cultivators visited the temporary farm at my head-quarters and inspected both the growing crop and also the drying process.

I have much more faith in the work of increasing the production of tobacco being accomplished at an early date by an improvement in the tobacco produced than I have by the reduction of the land revenue on the land where the tobacco is grown. The average reduction of land revenue has not, I think, exceeded Re. 1 per acre, whereas I have not heard of an instance where the improved seed and method have not given an increased profit of Rs. 50 per acre.

The figures of importations and exportations given in this report are those for the port of Rangoon only as I did not have them for the whole of Burma.

NEWS.

The North-Western Provinces and Oudh.

The first report on the prospects of the Cotton Crop of the North-Western Provinces and Oudh is as follows:—"Rains timely and generally well distributed in the important cotton-growing districts. Total estimated area about 10 per cent. larger than last year. Plants strong and vigorous. Flowers a little injured from the late heavy rains towards the close of August, but on the whole promising. Taking 100 to denote a full average crop, present prospects estimated at 85."

Bombay Presidency.

The first report on the prospects of the Cotton Crop in the Bombay Presidency is as follows:—"The forecast refers to the early districts of the Deccan only. Khandesh; area roughly estimated at 1,000,000 acres, that is, 300,000 acres more than last year and 225,000 acres more than last seven years' average. Sowings early and unusually good season expected. Ahmednagar; area about 50,000 acres and Sholapur about 25,000 acres. In

both districts area considerably above last year and in Ahmednagar above average. Incomplete figures for Nasik, Poona and Satara where, as in Khandesh, season is favourable, crop healthy and prospects good.

Coorg.

The Coffee forecast in Coorg indicates an outturn of about 2,700 tons. The absence of showers before blossoming, and the heavy rains which fell while the plants were in blossom have injured the prospects of the crop, but the outturn will still be nearly 2 cwt. per acre.

Age of Cattle.—The age of horned cattle many generally be known by rings on the horns till their tenth year; after that time they give no indication of age further than that the animal has passed its tenth year. The first ring appears on the horn after the animal has passed two years old—soon after, as a rule, though sometimes before that age. During the third year the ring gradually increases, and at three years of age it is completely formed. The second ring appears during the fourth year, and at the fifth year complete. After that period an additional ring is formed each year. A cow with three rings is six year old: with four rings she is seven years old. No new rings are formed after the tenth year; the deeper rings, however, and the worn appearance of the horns, are pretty sure indications of old age. In Polled cattle the age can only be known by the teeth.

American Humour.—The basest fraud on earth, is agriculture. The deadliest *ignis fatuus* that ever glittered to beguile and dazzled to betray is agriculture. I speak with feeling on this subject, for I've been glittered and beguiled, and dazzled and destroyed by this same arch deciever. She has made me a thousand promises, and broken every one of them. She has promised me early potatoes, and the rain has drowned them; late potatoes, and the drouth has withered them; She has promised cherries, and the curculio has stung them, and they contain living things, uncomely to the eye and unsavoury to the taste. She has promised strawberries, and the young chickens have devoured them, and the eye cannot see them. No wonder that Cain killed his brother. He was a tiller of the ground. The wonder is he did not kill his father, and then weep because he had not a grandfather to kill. No doubt his early Rose potatoes, for which he paid Adam 7 dols, a barrel, had been cut down by bugs from the head waters of the Euphrates; his Pennsylvania wheat had been winter-killed and was not worth cutting; his Norway oats had gone to straw, and would not yield fine pecks per acre, and his black Spanish water-melons had been stolen by boys, who had pulled up the vines, broken down his patent picket fence, and written scurrilous doggerel all over his back gate. No wonder he felt mad when he saw Abel wistling along with his French merinoes worth 8 dols. a head and wool going up every day. No wonder he wanted to kill somebody, and thought he would practice on Abel. And Noah's getting drunk was not at all surprising. He had become a husbandman, and drowned his sorrows in the "flowing bowl." The fact is agriculture would demoralise a saint. I was almost a saint when I went into it. I'm a demon now. I'm at war with everything. I fight myself out of bed at four o'clock, when all my better nature tells me to lie till seven. I fight myself into the garden to work like brute, when reason and instinct tell me to stay in the house and enjoy myself like a man. I fight the pigs, the chicken, the moles, the birds, the bugs, the worms—every-in which is the breath of life. I fight the docks, the burdocks, the mulliens, the thistles, the grapes, the weeds the roots the whole vegetable ...

"Notes on Milk": by Dr. F. Bond.—The complete analysis of milk is an operation which requires special skill, and is quite beyond the capability of an untrained person. Fortunately, however, it is possible, by very simple means, within the reach of anyone, for every purchaser of milk to ascertain whether the milk, with which his milkman supplies him, is as good as that which he can obtain from others at the same price; and, even to go further still, and to satisfy himself as to what is its absolute richness, and whether it varies much from day to day. By the first test the buyer of milk, can make the same comparison in the case of milk which people ordinarily make in purchasing other articles of food, and can thus find out where he can obtain the best value for his money; by the second he can exercise a control on the actual article supplied to him, which is of more importance in the case of milk than of any other article of food; firstly, because it is itself so liable to variation, even when not fraudently tampered with, and, secondly, because there is so much temptation to tamper with it on the part of those through whose hands it passes. The following simple method of testing milk will enable anyone to compare roughly the relative richness of any two samples of milk, and though it will not give the *absolute value* of either, it will show which is the richer of the two, and, consequently, *which is the cheaper at the price paid for it.* Take two clean glass tumblers and introduce half a pint of clear water into each. Then drop twenty drops of one sample of milk into the one and the same number into the other. Then stir them both well up, and observe in which of the two the opacity is the greatest: that one will be the richer of two. The determination of this point may be faciliated by droppingin to each of the glasses a shilling, sixpence, or other coin, and comparing the distinctness of the view of it obtained by looking down on it through the water from a little distance above it. It must be noted that the accuracy of this test depends upon the several steps of the process being carried out with equality in both samples, *e. g.*, the quantities of water must be the same, the milk must be dropped from the same dropper, and the distinctness of the impressions on the two coins used must be as nearly as possible the same. The milk may be dropped from a small, clean bottle, or, better still, from a glass dropping tube. In either case the bottle or tube must be well rinsed with the second sample, after it has been used with the first, before dropping, so as to prevent any confusion in the results. In this, as in all other tests for milk, it is essential that the milk should be fresh, that the samples should be taken

directly after they are supplid by the milkman, or, that if they are allowed to stand for any time, they should be well shaken before being taken. A much more effective application of this mode of testing may be obtained by the use of the Lactoscope, a simple appliance, by which the absolute richness in butter fat of any sample of milk can be easily determined with sufficient accuracy for ordinary purposes.

Messrs. J. Thomas & Co's. Price Current of 19th October.—We have no news to report regarding the crop, and we do not think it necessary to make any alteration in the figures given in our last Circular; but, possibly, the total from Behar may not quite come up to the estimate, owing to the very bad returns from the khoontees. About 150 chests of native indigo have arrived, but so far no business has transpired, sellers not being anxious to operate, owing to the advance in the London October sales quoted by telegram. The London October sales commenced on the 11th instant, and the result telegraphed by Reuter is as follows:—

	chests.
Declared for auction on 8th September ...	6,100
Single added	700
	6,800

	sold	chests.
Total Bengals ...	„	... 900
„ Oudes ...	„	... 100
„ Kurpah & Madras	„	... 1,800
„ Bombay	„	... 300
		3,100

	chests.	
Withdrawn	... 2,800	
Bought in	... 900	
		3,700
		6,800

Bengals fine, and good ...	.... 3d to 4d lower.
Oudes, generally	... 3d to 4d higher.
Kurpahs and Madras Dry Leaf, generally	... par to 3d „

Sir R. Paget has given notice in the House of Commons that, early next Session, he will move that the Agricultural Department be placed on a more permanent basis, and be provided with sufficient funds and staff to enable it both to undertake and supervise scientific experiments with regard to diseases of stock, profitable cultivation of various crops, and other practical matters connected with agriculture.

Moriani, 18th October.—October opened well, but it is not proving so favourable as was anticipated. The heat is much above the average of last year, but in consequence of the entire absence of rain the flushes of tea obtained are very light but the leaf of good quality and what is being lost in quantity is being made up by quality. The seed crop is ripe earlier this year than last and those who have been fortunate enough to sell seed are busy picking it. The most of what has been sold in this district is being despatched to Ceylon, the prices obtained ranging from Rs. 35 to 70 a maund, according to *jat*.

Russia.

In Southern Russia, a rather more active trade in grain is reported owing to some considerable purchases of Ghirka wheat and barley. Supplies had been fairly regular, chiefly by sea, the bulk being comprised of barley and Ghirka wheat.

Europe.

On the Continent of Europe, the cereal harvest has been completed. Markets generally are steady although very quiet, but Amsterdam is weaker. According to the official return of the wheat harvest of 1886 in France, issued by the French Government, 6,993,257 hectares (17,482,890 acres) were under cultivation, producing 105,412,877 hectolitres 36,156,000 qrs.) against 6,969,062 hectares (17,422,650 acres in 1885, producing 110,277,450 hectolitres (37,825,000 qrs.) last year. These estimates are largely in excess of those issued from other sources.

Returns of Rail-Borne Traffic of Punjab for the Quarter Ending 30th June 1886.

The returns for the quarter ending the 30th June 1886 show a falling-off as compared with the returns for the same quarter of the previous year in most of the principal staples of commerce, both in imports and exports. Imports of coal fell from 444,787 maunds to 289,114 maunds; imports of European cotton piece-goods from 150,314 maunds to 126,707 maunds; imports of iron from 707,194 to 442,801 maunds, and imports of sugar from 501,289 to 481,079 maunds. Exports of wheat fell off by 57 per cent., and exports of oil-seeds by 67 per cent. The falling-off in the coal trade occurred entirely in imports from Bengal. With this exception the depression appears to have affected principally the Karachi trade. On the other hand there was an improvement in the trade with Bombay both in imports and exports.

The depression of the Karachi trade at the expense of the Bombay trade appears to be partly due to the continued working of the Rewari-Firozpur line in opposition to the North-Western Railway system, thus drawing off the trade of the south-east corner of the Province to Bombay, instead of allowing it to go to its natural outlet, Karachi. This is not, however, sufficient to account for the whole decrease. Perhaps an explanation is to be found in the temporary stimulus given to trade in the spring of 1884-85 by the large Camp of Exercise at Rawalpindi, and by the rumours of impending war which were in circulation at that time. In connection with the wheat trade it is noticeable that, according to the *Indian Agriculturist*, the Washington Agricultural Bureau's Monthly Report estimates the American wheat crop for the current year at ninety million bushels, or about 2½ million tons above last year's crop.

ENSILAGE.

By Sir J B. Lawes, Bart., LL.D., F.R.S.

In the Agricultural Gazette of last year we published a series of articles on Ensilage. The crops we selected for the experiment were red clover, and pasture grass. The whole of these crops were weighed and chaffed as they were placed in the silos, and the silage was also weighed as it was taken out. By devoting great care and attention to all the operations, we hoped to arrive at some fairly accurate estimate of the losses which took place in the silo. The silage made was in all cases of what is called sour silage, and the food was used in the production of milk and meat. The general conclusions drawn from the experiment may be summed up as follows —

(1) that the crops which had been cut green and placed at once in the silo, could be preserved for several months in a state suitable for food for stock.

(2) That during fermentation in the silo, some of the nitrogen of the fresh food was destroyed while another portion was changed from the albuminoid form to compounds of a lower food value.

(3) That there was a considerable loss of other food compounds, amounting probably to about one tenth of that contained in the crops when placed in the silo, while on the other hand there was no clear evinence that during fermentation any food was produced from substances which were not foods when placed in the silo

(4) That with very few exceptions, cows took readily to the silage, and when used with appropriate food—although slightly inferior to mangels—it proved to be well adapted for dairy purposes.

(5) That when used with cake and corn for fattening oxen, it proved to be quite equal to swedes and clover hay, used with like quantities of cake and corn.

These results if they do not confirm the exaggerated statements that have been put forward by some of the advocates of silage at all events prove it to be a useful food, and as such we may consider that further investigations in regard to its properties would be desirable. Since we published our experiments, some important investigations in regard to silage have been carried out by the Bath and West of England Agricultural Society. Six silos were filled from a grass field, and the different qualities of silage were produced by the pressure being applied at different periods. But owing to the large difference in the losses of dry matter in the three pits of sweet silage, the question as to whether there is a greater loss of food material in making sweet silage, than in making sour silage remains still unsettled. If we take the mean of all the six experiments, the loss of food substances during fermentation amounts to about 14 per cent., which agrees very well with our own results on pasture grass. In addition to the six experiments with silage, a portion of the grass used for the silos was made into hay, under very favourable circumstances in regard to weather. The loss of dry matter in the hay did not amount to more than three per cent., and the analysis showed that the grass, in the from of hay, had undergone much less change, and had suffered much less loss, than the grass in the form of either sweet, or sour silage.

The advocates for silage—as against hay—insist strongly upon the value and importance of succulent food; and there is evidently room for a well conducted and careful set of experiments to be carried out in this direction—but, apart from this, the evidence of the Bristol experiments points to the superiority of well made hay to silage, both in its sweet and its sour state.

The crops which we placed in our silos last year were first and second crops of red clover and oats. In regard to the red clover we shall confine our remarks to the changes which take place in the silo, and the losses which occur during fermentation, and merely allude generally to its feeding properties. As regards the oats we, propose to compare the oat silage, with a crop of ripe oats, fed with its straw. The proposed employment of ensilage to all the crops grown upon the farm makes it desirable that their respective merits in this form should be investigated. It will be observed that the proportion of seed to the other parts of the plant, varies in a very remarkable manner in the crops we are in the habit of growing. For instance the weight of barley grain is often equal to the weight of straw and chaff. A luxuriant first crop of red clover will produce hardly any seed, and with many of the pasture grasses the seed is remarkably light. We might expect from this that at the time of blooming—or shortly after that time—a plant which produced a large weight of seed in proportion to its stem and, leaves would add more to its weight between the time of blooming and that of ripening, than a plant which produced very little seed. It is said that the proper time to cut pasture grass for hay is when most of the plants are in bloom, as if they are left longer the stems become harder and more woody, and although there may be more dry matter formed, it consists of woody rather than nutritive matter.

t is true that in the case of the cereal grains the stems also become harder after blooming, but at the same time the seed increases largely in weight, and unless this weight was at the time, existing in the leaves and stem, and was merely carried up into the seed, there must be a considerable loss of food material when the crops which produce heavy seeds are cut, about the time of blooming.

Silo No. 2 was filled with 80 tons of 1st crop red clover which weighed when taken out 69 lbs. per cubic foot, and 48 tons of 2nd crop which weighed 35 lbs. per cubic foot. The first crop, which was very succulent contained only 17 per cent. of dry matter, while the second crop contained 25 per cent. of dry matter. I may mention that when this silo was filled and pressed, the silo No. 1 divided by a party wall was empty nd owing to the pressure a small crack took place in the wall, the result being that from the floor of the empty silo we took out 4095 lbs. of juice.

The juice which was taken out of the empty silo, accounts for a very small portion of the loss actually sustained, as of 80 tons of first crop green clover put in, only 46 tons were weighed out, thus making a loss of 34 tons due to draining, fermentation, or evaporation. Last year there was a very large loss of water, but the loss of dry substance in the red clover silage was comparatively small. This year, however, the loss of food materials is very large, amounting to nearly 28 per cent. of the dry substance.

Of 14 tons of dry substance contained in the clover when put in, there is a loss of nearly 4 tons. Of the nitrogenous substance nearly one third of the whole has been lost, and of mineral matter the loss is more than one third of the whole. These facts all point to the loss being in a large measure due to drainage, rather than to fermentation, but at the same time we must not forget that in the German experiments—which were made in tight casks—there was a loss of dry substance by fermentation equal to, and indeed exceeding the amount found in our clover, while at the same time there was but little loss of water.

Such being the case it would certainly appear advisable either to diminish the pressure applied to the silage, or to cart the crops in a less succulent condition. This year our clover when placed in the silo contained 82½ per cent. of water, which is cosiderably more than it contained last year. Part of the second crop of red clover—which was placed on the top of the first—had beed mown some days before it was put in the silo; it contained 75 per cent. of water, but some portion of this would be due to the fact of rain adhering to the partly dried plant. It will be noticed that there is very little loss of water, or of dry substance in the silage, and that the pressure which produced in the 1st crop of clover silage a weight of 70 lbs., in the second crop only produced one half of this weight or 35 lbs.

In table No. 2 will be found the amount of the second crop of red clover and oats put in, and taken out of silo No. 1, together with the actual and calculated loss of each constituent. The loss of water in the clover was but small—as was the case in the second crop of red clover in silo No 2—and the weight of a cubic foot of silage was nearly the same in both cases, being 34½ lb in one pit and 35 lb in the other. In silo No. 2 the loss of the dry substance, and of the various constituents of the second crop of red clover was very small, while in silo No. 1 the loss of dry substance amounted to nearly 16 per cent, and of crude nitrogenous matter, the loss was between 13 and 14 per cent.

With so small a loss of water, it is impossible to account for any considerable amount of this loss of the solid matter of the crop by drainage: The silage only contained 1182 lb. less water than the clover put in, and assuming that the drainage juice contained 10 per cent. of dry matter, this would reduce the amount to 118 lb. whereas the loss of dry substance was 1326 lb., more in fact than the water itself. The distinction between the second crops of red clover placed in silos No. 2 and No. 1, was that in silo No. 1, the quantity of red clover put in was much less than that in No. 2, add indeed was all cut fresh and put in in one day. The temperature ranged from 71 to 90 F. Silo No. 2 was filled between August 21st and September 3rd. In this case part of the crop had been cut some days, during which time it had been exposed to rain, and the result was that the temperature ranged from 69 to 82 F. The much larger loss in silo No. 1 is therefore to be explained by a more active state of formention.

The oats which occupied the lower part of silo No. 1, were a portion of some spring oats which were selected with care from the middle of a field. A given area was cut green when the grain was in a milky state, and an equal area was allowed to ripen its seed, the object of the experiment being (1) to ascertain what increase there was in the weight of the crop during the period of ripening, and (2) to ascertain the feeding properties of the silaged oats as compared with the ripe crop. The loss of water in the oats silage was exceedingly small, being less than two per cent. Of the dry substance of the crop, the loss amounted to 15 per cent., and of crude nitrogenous substance, the loss was 16 per cent.

These are very similar in amount to the losses on the second crop of clover in the same silo, and they are also very similar to the losses on the 1st crop of pasture grass given in this journal last year.

The total depth of the silage was 16 feet and two samples were taken from the 2nd and 3rd four feet, 2 samples from the next 3 feet, and one sample from the bottom, which was only one foot in depth. The dry matter is highest at the top where it is nearly 31 per cent. In the second layer, there is just 30 per cent. of dry matter, in the third layer the dry matter per cent, is not quite 29, and in the foot at the bottom it is only 24½ per cent.

The oat silage shews a gain, instead of a loss of water—as compared with the oats put in—and it is tolerably evident that this gain is partly due to juice of the red clover which has passed through the diving wall. This juice is very rich in mineral matter, and in this bottom layer of silage, the ash is very much higher than in any of the other layers.

The difference in the composition of the food material in the upper and lower layers of the oat silage is not very remarkable, the soluble carbo-hydrates, and chlorophyll are respectively 11½ and 15½ per cent. in the two bottom layers of silage, as against 21 per cent. in the two upper layers, while the digestible fibre is higher in the bottom silage than it is at the top. In the Bristol silage where the six silos were filled with the same grass, but where sweet, sour, aromatic, and fruity silage was prepared by different processes of filling and pressure, the chemical composition does not fluctuate much more than is the case in different depth of our own silage. It is somewhat remarkable that while the woody fibre of the pasture grass as put into the Bristol silo amounted to not quite 35 per cent., in the hay it was one per cent. more, and in some of the silage the amount exceeded 39 per cent. In our oat silage the woody fibre was considerably less, the average being 34½ per cent., an amount almost exactly the same as that of the pasture grass employed at Bristol.

The oats placed in the silo were spring sown, following wheat, and were manured with 2 cwt. of nitrate of soda and the same amount of super-phosphate of lime per acre. The crop was a very large one yielding 93¾ bushels per acre of the very low weight of 35 lbs. per bushel. The following table gives the weight per acre of the crop cut green, and of ripe crop, together with the weight of actual dry substance in the two crops, and the gain of dry matter in the ripe crop.

Rothamsted Ensilage Experiments, 1886.

Particulars of spring oats, silaged green and left to ripen.

PRODUCE PER ACRE.

Oats Cut Green.		Oats Left to Ripen.						Gain of Dry Matter by Ripened Crop.
		Fresh Produce			Dry Matter.			
Fresh Weight	Dry Matter	Corn.	Straw	Total	Corn	Straw	Total	
lbs	lbs.	lbs.	lbs.	lbs.	lbs.	.....	lbs.	lbs.
19,932	6,565	3,291	5,018	8,372	2,706	4,123	6,829	264

The green oats when cut for silage may be said to have been rather too mature than the contrary, this is tolerably evident by the small increase which took place between the time of cutting the oats for silage purposes, and the maturing of the crop, the dry matter per acre being 264 lbs.

Before the oat stack was properly thatched, a heavy thunder storm occurred, and a good deal of wet penetrated that portion of the crop which was set apart for the feeding experiments, the straw in consequence was found to be somewhat musty, and not well adapted for food, it was therefore decided to use for the purpose some oats and straw of exactly the same weight, taken from another field. The Short-horn oxen were selected with care from a herd of 40, the five to be placed on the oat silage resembling, as far as the eye could judge, the five to be placed on the oat crop. The weights also were arranged to correspond as much as possible, and the two lots did not differ more than 5 lbs. altogether.

The increase of the oxen in the two lots was far from being regular, although it was much more so with the animals which were fed upon the ripe crop, than with those fed upon silage. The mean increase upon the ripe crop is fairly good, being at the rate of 16 lbs. per head per week, or 14·3 lb. per 1000 lb. live weight. This amount resembles very closely the increase obtained in the experiments published in this journal last year, when five oxen were fed on clover chaff, swedes, cake, and corn and gave a mean increase per 1000 lb. live weight of 14·8 lb. per week. The oxen on the oat silage increased only 7·4 lb. per week, or not quite one half of the increase of the oxen fed on the ripe crop. The reason of this low rate of increase is clear enough when we consult the figures given in the table* of food consumption.

A glance at the table shows at once, that the oxen upon the oat silage would not eat a sufficient amount of their food to enable them to increase at the same rate as the oxen on the ripe crop. With 5 lb. of cake per head daily, they ought to have consumed 50 lb. of silage daily instead of 30 lb. It is somewhat difficult to account for the want of appreciation of the silage which was shown by these

*This and all other tables have been omitted.

oxen. A sample taken to the Ensilage Commission was pronounced to be excellent. Dr. Voelcker's analysis shows that the woody fibre is not higher than the woody fibre in the Bristol silage, made from pasture grass. And so much has been said about the value of condiments, in tempting animals to consume indifferent food, that we tried the experiment of moistening the silage with a solution of sugar and water, but with no better result. In digestible fibre and soluble carbohydrates, it is quite equal to the Bristol silage made from meadow grass. Still, after all that chemistry has to say on the subject, we must in this case accept the verdict of the animals which have pronounced against the silage. The oxen on the ripe crop consumed nearly 16½ lb of dry food, instead of not quite 9 lb. of dry silage.

Of the 20 lb. of oat crop which was consumed daily by each ox, there would be 8 lb. of corn; this, with the addition of 4 lb. of cotton cake, would be a large allowance of food of high quality, and, I think, that there can be very little doubt that of the starch—which formed the nutritious part of the grain—did not exist in the oats when cut for silage purposes; and as there was a loss in the silo of 16 per cent. of the organic matter of the oats, it is probable that the greater part of this loss would take place in the soft, starchy matter. It is also quite probable that if we had cut the oats a week sooner, the feeding results would have been more favourable, but in that case, the acreage weight would have been so much less, and instead of a difference of 264 lbs. between the dry weight of the crop when silaged, as compared with the ripe crop—we might have had a difference of 1,000 lb.

Experiments in feeding which we carried out a great many years ago, showed that a very large amount—as much as one half of the so called woody fibre of chemists—was capable of being digested by animals. There can be no doubt that our oat silage contained too large a proportion of indigestible woody fibre, to make it a satisfactory food for a fattening animal, and that a fermentation in the silo does not appear to have made this indigestible part of the oats more easy of digestion. So far as these experiments therefore are to be trusted, they are cetainly unfavourable to the use, for silage purposes, of crops which produce large seeds.—*Agricultural Gazette* (*London*).

WHEAT CULTIVATION IN INDIA.

An exhaustive review of the subject appears in the annual report of the American Department of Agriculture just published, from which the following particulars are quoted by the *Times* :—

India is a country 1,900 miles in length and 1,500 in width, and comprises an area equal to that of the United States east of the Mississippi river. Little wheat is, however, raised south of the 25th parallel, the North-West Provinces and Oude being best adapted for wheat cultivation. These comprise an area of 106 111 square miles, almost a flat plain. The soil is alluvian, chiefly of clay and sand, deposited by fresh water, as there is a total absence of marine shells. Except in the mountainous range of the Vindhyan chain that crosses the southern portion of these provinces, there are no rocks, stones, or minerals other than silica and some mica, which are in the finest particles. The climate is the most favourable in the world for agricultural products, it being possible to grow the crops of both the hottest and the coldest countries. The seasons for the different crops are fixed and regular, and there is not a month in the year in which the farmer cannot work in the fields. There are two grain seasons in the year—one in the rainy season, which commences about the 15th of June, and continues until September and October. The winter crops, such as wheat, oats, and barley, which are sown in October and November, are harvested in March and April. There are occasional showers during the winter, but seldom any from March to the middle of June. Between these two grain seasons the farmer gives his attention to fruit, vegetables, and sugarcane.

The farmer has scarcely any tools, but what he has are of the simplest kind. There being no hard gravelly soil, no stiff clay, no hard pan, and no sticky, calcarious soil to work, is a grand advantage to him. By a very crude implement, which can scarcely be called a plough, the land is turned up. This plough consists of a triangular piece of wood, about eighteen inches in length and six inches in diameter at the larger end, the other being pointed. On the flat side of this piece of wood a groove is made, into which a flat piece of iron, a foot in length, an inch wide, and half an inch thick, is inserted, and held in its place by a staple. The staple underneath does not interfere with the rooting. The iron bar, which is pointed, serves as a nose, or point, to the plough The larger end of this triangular piece of wood is mortised into an upright stick, the latter about three feet in length, at the top of which is a wooden pin on the front side for the handle. About eighteen inches from the ground, a strip of board, three inches wide, an inch and a half thick, and eight feet long, is inserted into the upright stick, and serves as a beam and a tongue. The yoke is a straight stick, six feet long, three inches in diameter, with four wooden pins, each six inches long, one on each side of the

neck of the bullocks. A small hemp rope, or grass twine, goes under the bullocks' necks to keep the yoke in its place. The beam of the plough has a few notches under it near the end, and is fastened to the yoke by a small grass rope. The plough makes no furrow, but simply roots or tears up the soil, and the ploughman, with his little goad or whip in one hand, the other holding the wooden pin in the upright stalk, walks by the side of the plough. The cattle are of the Brahmini species, white, slender-bodied, long-legged, and very lean. About the only food they get for months before the rain is "bhoosa," or wheat straw and chaff. Ploughing is hard work for both the little cattle and the man, and best a man can do is to tear up three quarters of an acre a day, and the work then is poorly done. The land has to be ploughed in this way a number of times, especially for the more substantial crops. The cattle cost from £1 to £4 a pair, but the average price is about £1 12s. The average price of a plough is 1s. 8d. The only other implement used is a log or slab of wood 6 feet or 8 feet long, drawn sideways across the field by one or two pair of cattle to crush the clods and smooth the surface. After the land is pulverised, and finally this is well done, too, the last ploughing takes place, when a man or woman dribbles the seed from the hand into the furrow.

The next operations are reaping and threshing. The reaper consists of a blade of iron 6 inches in length, 1 inch in width, and curved like an old-fashioned sickle, with a notched edge and a short handle. Its cost is 2d. The harvester sits upon his heels, cuts a handful of straw, which he lays down, and then waddles on without rising, and cuts another lot. He cuts about one-twelfth of an acre a day, for which he receives 2½d., out of which he has to board himself. After this primitive reaping machine comes a binder, who gathers up the grain and binds it into sheaves. It is then shocked, and after a day or two carted to the threshing floor. The threshing machine consists of a floor—a bit of hard ground—a stake, a number of cattle, and a driver. The grain straw is piled around the stake in the floor, the cattle are connected by a rope fastened to the end of the stake, and the driver keeps them until the straw is trampled very fine, into what is called "bhoosa". This, after the grain is separated from it, is fed to the cattle. The people raise almost insurmountable objections to any other mode of threshing, as this is about the only way in which the straw is made into "bhoosa," They not only thresh to get out the grain, but to break up the straw, and particularly to flatten it so that the cattle will readily eat it. Mr. Ozanne, Director of Agriculture for the Bombay Presidency had a large threshing machine sent from England, and made a contract with a landowner for 50 acres of wheat in order to try it. After the work had commenced, the landowner fell down upon his knees and piteously begged for the threshing to stop, as it would ruin him, for the cattle would not eat the straw. A chaff-cutter to cut up the straw would not do, as they hold it must be flattened and made up smooth as well as be broken up short. Until this objection is overcome, the people will use the cattle and the threshing floor. In time, when they can be induced to raise green fodder, or preserve grass as hay, or make ensilage, which is being introduced, they may adopt the civilized method of theshing. Yet their system works very well. They have the cattle and plenty of time, for after harvest they have less work to do, and the straw is very dry. The winnowing machine is a scoop, called a "soop," about 18 inches wide, made of reeds, and of shape like a large dust-pan. This is filled with grain and chaff and held in the wind, so that the chaff falling from it is blown from the grain. If there is no wind two men take a blanket, one at each end, and wave it between them, while a third dribbles the grain from the "soop." After threshing, the "bhoosa" is put into thatched ricks or bins, or in a corner of their huts or mud-walled houses, and fed out very carefully. It may be mentioned that the entire cost of the whole apparatus for wheat-growing, including the pair of oxen, is only about 37s.

So far as the mode of cultivation is concerned, the first thing the farmer has to do in preparing for a crop of wheat is manuring—that is, if he has any manure, and he usually saves all he can for his wheat. This is done in May or June, just previous to the rains. After the field has been ploughed, a flock of sheep or a number of cattle are herded on the field at night, and this costs the farmer something, as he does not usually own any sheep. The least number of times the land is ploughed is ten, and the greatest number thirty. About the end of September the sowing takes place. First, a Brahmin is consulted, if the farmer is an Hindoo, to fix the auspicious time, and, this being determined, he appoints a man to do the first sowing, after which any one can dribble the wheat, but not before. The farmer's wife, on giving out the seed, reserves a little, to which she adds more grain, and then distributes to the officiating Brahmin, the ploughman, and the labourers. The seed is carried in a basket and sprinkled behind the plough with the hand, the average quantity used being 150lbs. per acre. In some districts the wheat is carefully weeded, the weeds serving as food for the people, and the grass as fodder for the cattle. In

most places the fields have to be watered, and this has to be done usually about three times—first, after the seed germinates; next when the wheat is about to blossom, and the last time when the wheat is in the ear. The average cost of watering, which is by different facilities and processes, is about 10s per acre. The harvest for wheat sown in October takes place in March, but usually the harvest time is in April, the wheat ripening in about five months.

CROP AND WEATHER REPORTS.

For the week ending 29th September 1886.

General Remarks.—Except in the Central and Southern Divisions of the Bombay Presidency, where there has been a slight fall, and in Mysore, Coorg, Bengal, Assam, and Lower Burma, there has been little or no rain during the week under report.

The kharif crops in Bombay, the Central Provinces, Hydrabad, Berar, Central India, and Rajputana, are in considerable need of more rain, but, so far, the prospects are not unfavourable. In the North-Western Provinces and Oudh the kharif crops are good, and the harvest has commenced in some places. In Madras the standing crops are generally in good condition.

The rice crop in Bombay requires more rain; and in the Central Provinces it has suffered greatly from the long break in the weather. In Bengal the early rice is being harvested, and, except in inundated tracts, the yield is good; the winter rice generally promises well. In Lower Burma the rice crop is healthy and prospects are good.

Rabi operations have commenced in Bombay, the North-Western Provinces and Oudh, the Central Provinces, Hydrabad, and Rajputana, and sowings have been made in places.

The public health continues satisfactory in all Provinces.

Prices are rising in the Central Provinces and falling in Coorg. Elsewhere they are generally stationary.

For the week ending 6th October, 1886.

General Remarks.—Except in the Punjab, Sind, and Rajputana, rain has fallen in varying quantities all over the country during the week under report.

The kharif outlook has much improved in Bombay, the Central Provinces, and Berar, owing to the late rainfall, but in these Provinces and also in Hydrabad, Rajputana, Central India, and the Punjab, more rain is still required for the crops. The kharif harvest has commenced in parts of Bombay, the North-Western Provinces and Oudh, and Rajputana, and the prospects are generally good. The standing crops in Madras, Mysore, and Coorg are generally in good condition. In Bombay slight injury has been caused by excessive rain in parts of Poona and Ratnagiri.

The rice crop in Bombay, and especially in Central Provinces, is still in want of rain. In the latter Province the crop in the Chhattisgarh Division has been partially lost. In Bengal the early rice harvest has yielded fairly and the winter rice is coming up well. In Assam transplanting of the sali crop is nearly finished. The rice crop is being transplanted in Lower Burma, and prospects are satisfactory.

Cotton prospects in the Central Provinces and Berar are generally fair.

Sowing for the rabi are in progress in the North-Western Provinces and Oudh, the Central Provinces, Berar, and Rajputana.

The public health continues generally good in all Provinces

Prices are rising in a few districts of the Punjab and in Coorg and are falling in the central Provinces and Mysore. Elsewhere they are generally stationary.

For the week ending 26th October 1886.

General Remarks.—During the week under report rainfall has been almost confined to Burma, Madras, Bombay, excluding Sind, Mysore, Berar, Hydrabad, and the Central Provinces. In Bengal, the North-Western provinces and Oudh, and Central India rain fell in places, but the showers were light.

The kharif harvest is in active progress in Bombay, the North-Western Provinces and Oudh, the Punjab, and Rajputana, and a good outturn is expected. In the Central Provinces, Berar, Hydrabad, and Central India, where the harvest has not yet commenced, the prospects of the standing kharif are improving, the recent rain having been of benefit to the crops. In Mysore the crops are in good condition, and in Coorg the rabi has been harvested. In Madras prospects are good, but in some districts the harvest is yielding an outturn below the average.

In Bombay the rice crop is generally good, except in Ahmedabad, where rain still urgently wanted; and in the Central Provinces the crop has improved by the recent rain. The early rice harvest in Bengal has been completed, and the winter rice generally looks well, though in Behar and East Bengal some injury has been caused to it by floods. Preparations for the winter crops still continue in Assam. In Burma

Sowings for the rabi are generally in active progress in Bombay, the North-Western provinces and Oudh, Rajputana, and the Central Provinces, though in the last-named province they have been retarded in places by rain. In Bengal, the Punjab, Hydrabad, and Berar sowing has also commenced. In the Punjab rain is needed.

The public health continues to be generally satisfactory everywhere.

Prices are rising in a few districts of the Punjab, fluctuating in the Central provinces and in Mysore, and falling in Coorg. Elsewhere they are generally stationary.

1. Report by the Director, Department of Agriculture Commerce, N.-W. P. and Oudh on Ensilage Experiments during 1885-86: From the Government of India.
2. Memorandum or the Prospects of coffee crop in Coorg: From the Government of India.
3. Monograph on Woollen Manufactures of the Punjab in 1885—86: From the Punjab Government.
4. Report of the revised Settlement of the Jhang District 1874—80: From the Punjab Government.
5. Report of the Agricultural Department in Assam for 1885—86 with Chief Commissioner's resolution: From the Assam Government. (2 copies).
6. Memorandum on the prospects of the cotton crop in the Bombay Presidency: From the Government of India.
7. Memo for the rail-borne Traffic of the Punjab: From the Punjab Government.
8. Journal of the Agricultural Students' Association for April, May and June 1886: From the Association.
9. Annual report on the Government Botanical Garden and Park, Nilgiris, for 1885—86: From the Government of India.
10. Report on the river-borne Trade of Assam for the quarter ending the 30th June 1886: From the Assam Government.

Thanks of the Editor are recorded for all the above contributions.

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A

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ASSAM AGRICULTURAL DEPARTMENT.—Of the reports of the different Provincial Agricultural Departments for 1885-86, that of Assam is the first to come to our hands. During the year under report, the department was in the charge of Mr H. Darrah, offg. Director. The most noticeable feature in the report is the settlement during the year made on cadastral results. The tract settled is one of 228 square miles, comprising nine mouzas in the northern part of Kamrup, which had been surveyed in the season of 1883-84. The regular settlement thus concluded amounts to Rs. 1,21,775 against Rs. 1,10,527 in the preceding year and a maximum of Rs 1,14,379 in the ten years preceding. This increase is largely due to cadastral survey carried under the supervision of the provincial agricultural department. That agricultural departments are not mere spending departments, or a luxury either, is thus proved by testimony of facts, the further corroboration of which if wanted could be got from the Agricultural Departments of the Central and other provinces. This increase of land revenue will not fall heavily on the people, because it is mostly due to readjustment of boundaries and more accurate preparation of field books, rentrolls and leases. Increase of land revenue naturally leads to decrease of taxation and the department which tends to alleviate the burden taxation is sure to be welcomed by the people.

Two supervising kanungus have been appointed for the two circles into which the above nine mouzas have been divided and a beginning has thus been made towards complying with the wishes of the Government of India as regards the creation of a supervising agency over the mandal, the functions of which latter class of officers are similar to those of putwaries in the North-Western Provinces Regarding the working of these mandals, the Director remark. "Some of the maps had been admirably corrected and it became abundantly evident that the want of will and not the want of ability on the part of the mandals had prevented most of their papers from being made equally accurate." The two circles of north Kamrup which have already been settled are 6,989 acres and 9,118 acres each respectively, acres obviously too large to be properly attended to by the mandals. This mistake has been found out and a scheme has been proposed by the Director to remedy it. Another tract of 21 mouzas extending over 473 square miles has been cadastrally surveyed and the village records prepared and revised to form the basis of settlement in 1886-87. This settlement is also expected to yield a further increase of land revenue, of Rs 10,493 on a revenue demand of Rs 2,12,000, the rate of increase being 4 95 per cent. If the amount spent each year on the various heads of survey, rivision and settlement on the these two areas be capitalized, the increase of revenue yields interest at 5·13 per cent for 1883-84 and at 4·71 per cent for 1884-85 upon the capital expended each year.

Of the heads into which the agricultural report of each province has been prescribed by the Government of India to be thrown, the second, third, and fourth heads, namely, analysis of districts with reference to famine, system of collection

of revenue and rental in precarious tracts, and measures of protection have been omitted, as famine is happily unknown in Assam and there are practically no precarious tracts and measures of protection therefore unnecessary.

CROP-EXPERIMENTS.—The summer rice crop was generally below the average in the Surma Valley, and up to the average in the Assam Valley. From 40 experiments with *aus* rice in the Surma Valley, an average outturn of 1,124lbs. per acre was obtained, against 1,130lbs., the year before, when the crop was again a poor one. *Boro* rice gave an average of 1,476lbs. per acre only, against 1,634 in 1884-85. In the Assam Valley the average outturn per acre of *áhu*, or broadcast rice, as determined by 241 experiments, was 1,332lbs., a figure which closely corresponds with the results of the experiments of the two preceding years, and which may be taken as appoximately representing the productivity of the alluvial soil of the Assam Valley under this kind of crop in an ordinarily good year. The highest average (1,743lbs.) was obtained in Nowgong, where the crop was particularly good. In winter rice or transplanted rice (*sáli*), there were 44 experiments made in the Surma Valley, giving an average of 1,479lbs. per acre, against 1,442 lbs. in 1884.85. The result of 57 experiments in *áman*, or winter swamp rice in Slyhet was an avarage of 1,263lbs. per acre against 2,006lbs. from 105 experiments in 1884-85; the difference speaks plainly to the injury done to this crop by last yea's flood. The Assam Valley average for *sáli* rice, as educed from 395 experiments in 1885-86, was 1,719lbs. per acre, the highest figure attained since these experiments were first instituted in 1881-82. The winter rice harvest of 1885-86 was, in fact, an exceptionally good one, especially in the lower part of the valley. In the Khasi Hills the average for upland rice was only 458lbs. per acre. and for lowland rice 960lbs. Both figures are under the averages of previous year. The rainfall of 1885-86 was less than usual, and the upland rice, especially suffered in consequence.

* * *

The mustard crop in the Assam Valley was not a good one. An average of 477lbs of mustard seed per acre was the result of 194 experiments. In the two preceding years the average had been 530lbs. The Surma Valley figures for this crop are never so high as those of the alluvial lands of the Brahmaputra, where it grows to perfection. The average obtained by 35 experiments in the Surma Valley in 1885 86 was 352 lbs. of mustard seed per acre, against 355 lbs.the year before, and 466 lbs. in 1883-84. Classified according to a first, second, or third year,s crop, the experiments of 1885-86 in the Assam Valley showed that the first year's average was 475 lbs, the second year's 445 lbs and in the third year the crop on the same piece of ground fell to an average of 377 lbs. per acre Similar results were obtained last year. It seems plain from these statistics that the light soil devoted to mustard-growing is, in fact, easily exhausted, and that the rapid changes of occupation in *chapari* mauzas are not dictated by mere caprice, but follow a natural law of agriculture in those tracts.

The year 1885-86 is the first in which experiment to as certain the outturn of the common pulse (*mátikalai*) of the Assam Valley have been systematically undertaken in all districts. Twenty-two experiments in Goalpara and Sibsagar in 1884-85 gave an average of 486 lbs. por acre for this crop. The experiments of 1885-86 were 130 in number, and average arrived at was 504 lbs. per acre. Experiments in cutting and crushing sugarace and boiling *gur*, both in Sylhet and the Assam Valley, show results differing considerably from those of 1884-85 in individual districts. The weight of *gur* per acre appeared from the Sylhet experiments of 1884-85 to be 1,482 lbs., but in 1885-86 it is nearly double as much. or 2,831 lbs. In Sibsagar. we have 1,035 lbs. in 1885-86 against 2,435 lbs. of *gur* per acre in 1884-85. These differences are no more than we should expect in the case of a crop which is casually cultivated, depends entirely upon the natural rainfall, and is subjected to the rudest process of manufacture. But the general results for the Province, during the past three years, diverge much less considerably, and are summed up by the Director in the statement that in Assam an acre of cane yields approximately 1 700 lbs. of *gur*; that the native sugar-mill extracts 44½ per cent, of the weight of the cane in juice and the juice yields 17½ per cent of its weight in *gur*, or 7¾ per cent. of the gross weight of the cane. These results were somewhat improved upon at a trial made of a country mill at Palasbari in Kamrup, in competition with a Bihia cane mill. The country mill, worked by eight men, extracted nearly 50 per cent. of the weight of the cane in juice, and the *gur* obtained was 9¼ per cent. of the gross weight of cane. The Bihia mill, worked by two bullocks with three men or boys. gave 67, per cent. of juice, and 14 per cent. of *gur*, on the weight of the cane crushed. The superioriy of the Bihia mill is evident; but it will hardly come extensively into use in Assam, so long as the cultivation of sugarcane and the making of *gur* remain the purely domestic industries that they are at present. The comparatively small importance of the sugarcane crop in Assam is well illustrated by the crop statis-

tics of the Brahmaputra Valley, and the Eastern Duars. Out of a total area of 1,461,291 acres actually under field crops (after deducting garden land and fallows), sugarcane occupied 20,660 acres only, or less than 1½ per cent. Pulse covered about 3½ per cent., and mustard 11 per cent. of the total area cropped. For the rest, summer rice accounts for nearly 20 and winter rice for nearly 60 per cent. of the same area. An attempt was made to forecast the mustard crop available for export in the February 1886. The calculation arrived at was that the probable export surplus of 1886 would be eight lakhs of maunds, or 588,000 cwt, and this forecast has been justified by the statistics actually registered since it was published.

* *

Among miscellaneous matters dealt with by the department in 1885-86, the most important were an attempt to prepare the way for improved cattle-breeding in the Assam Valley, and certain experiments with a view to determine the practicability of growing *muga* silk for the English market. Three bulls of the small Kenwaria breed were imported from Banda towards the close of the year, and placed in Gauhati, Tezpur, and Nowgong. Native cattle-owners will be invited to bring their cows to these animals free of charge.

As regards silk, 121 lbs. of *muga* yarn were sent to Mr Wardle of Leek in January 1886, at an average cost of Rs 3-11 per pound, exclusive of carriage. Again, 6,000 *muga* cocoons were sent to a gentleman in Calcutta who believed he had invented an improved process of reeling which would enable him to command a remunerative price for his yarn in England. The yarn reeled, however, was valued in England at a price insufficient to repay the cos of production in India An experiment on a larger scale was made by the Bengal silk Company, who were supplied with 3 lakhs of *muga* cocoons, costing Rs. 2 per 1,000, ; this expense was borne by the Government. These cocoons were reeled into 67 lbs. of yarn, besides 58 lbs. of marketable floss and waste. Unfortunately, the yarn was damaged on its way to England, and seems to have proved unsaleable, so that this elaborate experiment, which was designed to test decisively the possibilities of a trade in *muga*, has in reality decided nothing. The total expenditure of the Department in 1885-86 was Rs. 50,069, of which Rs. 4,056 were the cost of the survey schools, Rs. 29,397 were spent on cadastral settlement operations, and Rs. 16,616 was the cost of the Director's office and establishment, with its contingent expenditure.

* * *

Exhibitions of Silk Cocoons in the Punjab.—In compliance with Government orders instructions were issued both at Nurpur and Pathankot, the two places where the exhibitions were held in May 1886, that no prizes should be awarded to exhibitors who brought less than a quantity of cocoons fixed as a minimum. In Nurpur this minimum was fixed at 20 seers, but was subsequently reduced to 10 seers. Only two exhibitors brought more than 10 seers, and a provisional list was accordingly made of all those who would have been awarded prizes if the minimum had been fixed at 2 seers. The number of exhibitors entered in this list is 67, of whom only 13 showed over 5 seers. The two exhibitors who showed over 10 seers of cocoons have been awarded prizes to the value of Rs. 45, and the Commissioner's proposal to distribute a further sum of Rs. 372 to the 67 exhibitors entered in the supplementary list, has been sanctioned. The total number of exhibitors was 120, against 270 in 1884 and 864 in 1883. The amount of silk shown was 9 maunds as compared with 5¾ maunds in 1884 and 11¾ maunds in 1883. At Pathankot the minimum was fixed at 2 seers. Only 43 persons brought a quantity not less than the minimum. The limit was not, however, adhered to, and a large number of prizes was awarded to persons who brought smaller quantities. In all Rs. 690 were distributed in prizes to 113 exhibitors. The total number of exhibitors was 371 against 340 in 1884 and 543 in 1883. The quantity produced during the year is said to have been 44¼ maunds from foreign seed and 146 maunds 28 seers from country. For the future the minimum should be raised to 5 seers. It has also been decided that in future there will be only one joint annual exhibition, namely at Pathankot, instead of two as before.

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Mangoe Pest.—Mr. Frederic Moore, of Penge, furnishes the following note on the Mongoe Pest in the Agri-Horticultural Society's journal for October last. The mangoe beetle, referred in the Report of the Society's meeting of 23rd June 1886 was long since described by Fabricius as *Cryptorynchus mangiferæ*. It belongs to the tribe commonly known under the name of "Weevils." This beetle, infesting the mangoe fruit, as above named from the specimen sent from Saharunpur, and of which you kindly forwarded me examples for identification This beetle in its young larval state feeds upon the pulp of the fruit, and, I believe, that when nearly full grown and its jaws are sufficiently strong, it enters the seed and devours the kernel, and afterwards transforms to the perfect beetle within the seed, thus not only damaging the fruit but also destroying the seed. It could be easily ascertained

for certainty whether the larva does enter the seed and transforms therein to the perfect beetle by an examination of the affected fruit; and a detailed account of the habits of this pest, both in its larval and beetle forms, would be of great interest. I hope, therefore, some of the Society's correspondents will give their attention to the subject and favour you with the results. With the view of lessening the numbers of the beetle and possible diminution of its destructiveness, I would suggest that all affected fruits should be collected as soon as they show signs of the beetle's attack, and the entire fruit thoroughly crushed beneath heavy stones so as to smash the seed and the larva within, or where this crushing process can not be done, the affected fruit should be put into a large pot or copper and thoroughly boiled in water.". The small insects sent by Mr. Gollan from Saharunpur, and which he states to be very destructive to the mangoe blossoms appearing in millions upon the flowers, and that they appear to subsist on the juices of the leaves and flowers, and particularly upon the pollen, &c. belong to the tribe commonly known as "Bugs." This pest is a small Cicadid, apparently of the genus *lassus*. They are not pollen-eating insects, but live entirely upon the juices of the leaves and young shoots of the tree. Gathering the leaves and burning them will go a long way in checking them. Burning large heaps of rubbish on the windward side of the mangoe plantations before and whilst the trees are in flower, would certainly have a beneficial effect in destroying the insects: The mangoe leaves which are numerously covered with small galls have nothing whatever to do with the development of these small cercopid insects, as is supposed to be the case by Mr. Gollan. These galls, of which there are two or three kinds upon the leaves, one being formed by the larva of a *Dipterous*, or two-winged fly (probably by that of a *Cecidomyia*), the others being formed by the larvæ of an *Hymenopterous*, or four-winged fly, belonging to the family *Cynipidæ*. The galls on the leaves sent by Mr. Gollan are, however, quite different from those described and figured on the "Gardener's Chronicle" for February 18th, 1871, as having been found on the mangoe near Calcutta in 1863, by my friend Mr. Arthur Grote. These latter galls are very similar to the oak-spangles or button-gall's, occurring so numerously on the leaves of European oaks, and the insects forming them has been named *Neuroterus mangifera*."

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QUALITY OF BUTTER.—The following is an interesting extract from a letter on British butter industry in *Daily News* (London) of Oct. 14th:—At the Ontario Agricultural College in Canada, the Government erected an experimental creamery some two years ago. The cream from nearly 1,000 cows is received. The system of butter-making for the whole province is being rapidly changed, and much increase of wealth is going into the country in consequence. The institution is educational, and free instruction in the management of creameries and the details of scientific butter making is given to eligible young men. Why does not the Imperial Government aid English and Irish farmers in a similar way? Contrasted with the "mixing" Brittany process of Normandy, the Canadian creamery system has much to commend it. The desirable keeping properties, which add much to butter's worth, are by it conserved, and the natural and exquisitely delicious creamy flavour is preserved for weeks. The national importance of the subject will excuse me in encroaching further on your valuable space to state in popular terms some interesting facts known by perhaps only a few experts. They will make a fitting sequel to the historic article on butter in your issue of the 7th inst. The natural flavours of milk and its products reside mainly in their fat constituents. While milk is quite new its cream or fatty portion is comparatively insipid or lacking in flavour. By exposure to the action of the air (oxidation) the flavour is ripened or developed, and the colour of the cream and butter made therefrom is deepened. A warm temperature facilitates, and a cool temperature retards, the development of flavour. Thus butter made from cream, raised at the ordinary temperature of the atmosphere, in open shallow vessels (such as are commonly used in Brittany, England, and Ireland), has a much fuller and riper flavour when just made, than butter manufactured from cream raised in deep cans, submerged in cold water, as by the Canadian creamery system.

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The former butter has its best flavour within two days after it is made, while the latter—the creamery—may continue to have its best taste from three to five weeks afterwards The earlier development of flavour in that butter which is at its best just after churning proclaims it of the character defined by the adage, "Quick ripe, quick rottee." For such butter delicious while fresh, nobody claims keeping properties any more than for harvest apples the quality of keeping sound till spring time. On the other hand, the quality of creamery butter (as evidenced by the Ontario Government's display at the Colonial and Indian Exhibition, free for inspection and examination by all interested) shows that it has excellent keeping properties. The butter fat of milk is in

the condition of minute globules. These are collected into mass by the impaction of churning. Any after-working, "mixing" or "milling" that destroys the natural grain or texture of butter, thereby destroys its keeping properties, just as the bruising of fruit or the breaking of egg shells renders both of these commodities subject to speedy decay. As an article of diet, delicious butter is very different in its gastronomic effect from oleomargarine or any imitation compound. Fine butter (its peculiarity) aids weak digestion by instilling its own atoms between the atoms of more solid foods, thus assisting in their disintegration for assimilation. It will be my satisfaction, as an humble servant of my own province and of the Greater Britain, to give any further information I can that will be helpful in promoting the prosperity of the farmers of the Empire along the lines indicated.—JAS. W. ROBERTSON, *Govt. Supt. of Dairying for Ontario, Canadian Court, Colonial and Indian Exhibition, October 11th.*

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USSAR AND REH SOILS.—The interesting sketch by Mr. Duthie of the indigenous vegetation of usar and reh soils appended to the report of the Government Botanical Garden at Shaharanpur and Mussoorie for the year ending 31st March 1886, possesses more than a mere scientific interest. The existence of usar land is not difficult to detect owing to its being practically sterile and unfitted for the cultivation of any ordinary crop. It is further made evident, when the saline ingredients are in excess, by the appearance on its surface of a pure white efflorescence which, during certain seasons of the year, resembles hoar frost or freshly-fallen snow. It occurs in irregular patches varying in size, and their position usually corresponds in a general way to that of the principal water-channels, whether they be rivers or canals. The chief points for botanical consideration are:—(1) the nature of the existing indigenous vegetation; and (2) the possibility of extending the growth on such land of any kind of vegetation, whether indigenous or foreign. In the case of land which effloresces the first question is easily disposed of, as very few kinds of plants can exist at all on usar which has thrown up its free salts to the surface to any great extent. In the neighbourhood of Sikandra Rao, for instance, there are extensive tracts of land which are absolutely bare of vegetation. The first signs of plant life on the less impregnated soil appear in the form of a few sickly-looking specimens of the "usar" grass (*Sporobolus tenacissimus*), which a little further on begins to cover the ground and to constitute the only vegetation for a considerable distance. Occasionally may be seen a few clumps of "dub" *Eragrostis cynosuroides*). On strongly contaminated usar each of these grasses appears to be provided with the means of seeking for the nourishment they require from a less impregnated soil.

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The "usar" grass is naturally a surface feeder, creeping extensively along the ground, and, after the manner of "dub", sending down its root fibres from the joints of its horizontal stems. The "dab," however, has strong vigorous roots which extend vertically into deep soil in search of moisture, and by this means it is probably able to derive its food from a less poisonous stratum. Mr Dathie collected some curious specimens of "dab" grass which were growing in a depression of a piece of strongly-impregnated usar ground near Pilkatra, on the Ganges Canal. These plants had completely assumed the creeping habit of the "usar" grass by the protrusion of strong tufts of fibrous roots from horizontal rhizomes. The normal vertical roots having failed to penetrate the noxious layers of soil, the surface mode of growth was induced. On most usar plains may be seen little hillocks or ridges formed by the wind and the wash of rain. These ridges are continually being added to by the accumulation of leaves and rubbish; thus a very different kind of surface soil is produed on those elevated parts from that which surrounds them, and, like islands in the sea or oases in a desert, they give rise to little colonies of plants which could not exist for a day on the intervening reh-impregnated soil. Here may be found, for instance, "dub" grass growing in profusion; ber" (*Zizyphus nummularia*), a close growing bush which froms an excellent barrier for arresting wind-blown materials, and by its shade encouraging the growth of grasses and other herbaceous plants. Another cause which perhaps more than anything else favours the greater fertitily of these elevated patches is that which Sir. E. C. Buck pointed out some twelve years ago, namely, the concentration of reh salts in the soil of the depressed portions of usar land by the repeated action of surface drainage.

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THE AGRICULTURAL PRODUCE OF THE UNITED STATES IN 1885.—The total production of wheat is given at 24,500,000 qrs., value £55,000,000, as compared to 37,250,000 qrs. in 1884, valued at £ 66,000,300. The average yield per acre was not more than six bushels, and the wheat crop was very bad in California, Ohio, and Indiana, which are the chief wheat-growing States, and the Americans, despite their general opitmism, seem to be alarmed at theprospect of the competition of the wheat grown in the East Indies. The export of wheat, which was only 5,000,000 qrs. in 1884, rose to 6,150,000 qrs last year, two-thirds of it being sent to England. The manufacture of flour is concentrated at Minneapolis, Mil-

Yankee, and Chicago, the quantity exported to Europe last year being 7,659,022 bags, of which 6,807,358 went to England, while about two million bags were sent from the Pacific coast to China and and Japan, the total exports from the United States being over ten million bags, or just double what is was seven years ago. The yield of maize in 1885 is estimated at 141 million qrs., or about one-seventh more than in 1884, the area, under cultivation being about 67 500,00 acres, and the average per acre about 16 bushels. The area under cultivation has increased by about 30 per cent, during the last ten years. The oat crop of 1885 amounted to about 7 100 000 qrs., grown on 25 million acres this being equivalent to about 24 bushels an acre. About 350,020 qrs. were exported this being double what it was only two years ago The exports of rye and barley are next to none, the heavy duty on them in France and Germany amounting virtually to a prohibition. There is a proverb to the effect that wherever a human being is born an ear of corn grows to feed him, and so it may be said that in the United States there is an ox, a sheep, and a pig to each inhabitant, for while the total population is 57,000,000, there are 50,000,000 sheep, 49,000,000 head of cattle, and 44,000,000 pigs in the States. The export of live stock is as follows:—1884—190,158 oxen, 273,874 sheep, 46,382 pigs; 1885—135,890 oxen, 234,509 sheep, 55 025 pigs; while of fresh meat 60,000 tons of beef and 1,466 tons of mutton were exported, in 1884 and 57,000 tons of beef and 1,678 tons of mutton last year. The Chicago market, it need hardly be said, is the chief centre of the cattle trade, the stockyards covering 370 acres, and employing during the winter from 20,000 to 25,000 men. In 1885 these stockyards received nearly 10,000,000 head of cattle or about 30 trains, each of 20 trucks, per diem. Mr. Stone, referring to the trade in pork, says that next to Chicago, where about 6,000,000 pigs were killed last year, the principal centres of pork packing are Kansas city, Cincinnati, Cerad Rapids, St. Louis, Indianapolis, and Omaha, which kill about 10,000,000 pigs, the total consumption of pigs in the United States being about 29,000,000. Mr. Stone protests very stongly his report against the exclusion of American pork from France and Germany, upon the ground of its being likely to communicate trichinosis, and he asserts that the exclusion is not in any way justified. With regard to the export of dairy produce, this, he says, is much affected by the increasing production of oleomargarine, butterine, &c., and the export of cheese has fallen from £3 200,000 in 1883 to £2,000,000 last year, while the exports of butter dropped from £1,200,000 to £770,000 in the same period.—*Mark Lane Express.*

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RAILWAY BORNE TRADE OF BENGAL DURING THE QUARTER ENDING 30TH JUNE, 1886. In comparison with the quarter ending the 30th June 1885, the total showed a falling off of 11,61 026 maunds, or 12·21 per cent. In the case of imports, the decrease amounted to 6,44,297 maunds, or 11,75 per cent., and was chiefly in the trade with the North-Western Provinces and Oudh. In the case of exports the decline, which aggregated 5,16,029 maunds, or 12·14 per cent., was due to a contraction of trade with the Punjab, Sind, and Central Provinces. In the Behar block the imports showed a large decrease of 5 09,228 maunds, or 59·37 per cent., mainly on account of smaller supplies from the North-Western Provinces and Oudh of food-grains and "other aaticles of merchandise;" the increase of 1,73,412 maunds, or 5·38 per cent., in the export trade is attributed to larger quantities of undrained sugar having been despatched to Northern and Central India. Owing to smaller consignments of food-grains from the North-Western Provinces, the imports into the Western Bengal block declined by 53 518 maunds, or 32·49 per cent; the falling off of 91,431 maunds, or 30·48 per cent., in the export trade occurred chiefly under the head "all other articles of merchandise." In the Calcutta traffic the imports exhibited a trifling decrease of 1·84 per cent., but the exports showed a large decline of 33·45 per cent., chiefly under the head of "other articles" suppiied to the North-Western Provinces and Oudh, Sind, and the Central Provinces.

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The total quantity of internal trade within the Lower Provinces during the quarter under report, showed a large advance of 31,23,712 maunds, or 27·21 per cent., over the trade of the quarter ending the 30th June 1885. Owing to fair prices and brisk demand in the Calcutta market for export to the United Kingdom the trade in wheat carried downwards rose from 1,50,791 maunds to 15 54,251 maunds. Of the latter quantity, Calcutta received over 90 per cent. from the Behar block alone. A very large increase of 7,41,542 maunds occurred in the trade in rice, which was due both to good supply and active demand. Of the total trade, Calcutta received over 88 per cent., principally from Western and Northern Bengal. Consignments of gram rose from 1,32,000 maunds to 8,58,956 maunds, Of the quarter's supply, 5,24 656 maunds found their way into Calcutta, chiefly from Behar and Eastern Bengal. The trade in raw jute showed a large falling off of 2,55,019 maunds owing to the Calcutta market being dull. The quantity imported into Calcutta from Northerm and Eastern Bengal decreased

from 4,12,736 maunds to 1,59,949 maunds. The trade in linseed rose from 12,52,341 maunds to 23,94,094 maunds. With the exception of 7,554 maunds, which went to Western Bengal, the whole of the quarter's supply was consigned to Calcutta, where prices were high and the demand for export brisk. Of the imports into Calcutta, Behar contributed over 90 per cent., and Eastern Bengal over 7 per cent. The increase of 1,23,207 maunds, or 53·52 per cent., in the trade in European cotton piece-goods is attributed to an improvement in the material condition of the people in many districts. Of the quarter's trade, which amounted to 3,53,162 maunds, Calcutta exported practically the whole, viz., 3,53,142 maunds. The largest supplies went to the Behar block, viz., 2,21,588 maunds against 1,23,955 maunds in the year ending the 30th June 1885.

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GOVERNMENT BOTANICAL GARDENS AND PARKS, MADRAS.—The *Quillaja saponaria* thrives well in the climate of Ootacamund and can be readily propagated by means of cuttings. It still remains to be seen, however, whether the tree will prove as valuable here as in its native country, Chili. Tubers of the *Kumera* (*Convolvulus chrysorhizus*, *soland.*) have been raised and were found palatable. Give any information regarding their probable value as an article of diet for the people of this country. A new tuber (*Ullucus tuberosus*) a native of South America, which was received from Mr. Thiselton Dyer, has been found to grow freely in the open air at Ootacamund. Arracacha (*Arracacia esculenta*) or the Cochin-China tuberous-rooted vine, has not yet produced any tubers or the latter any fruit. Experiments in the culture of hops have been commenced. The failure in the stock of Ipecacuanha plants which was reported last year has been effectually remedied, but Mr. Lawson thinks that the climate of Nilambur is more suited to this plant than that of Barliyar. The remarks on the successful growth of certain *Coniferæ* on the Nilgiris are interesting. The receipts for the year were Rs. 3,055-7-6, the budget estimate being Rs. 2,850, and the expenditure was Rs. 26,619-4-1 against an allotment of Rs. 27,229. The decrease was largely due to the fact that less than half the grant for the library was expended, as it was not known what books could be transferred from the Central Museum Library.

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BRICK TEA.—The process of manufacture is thus described by Mr. Baber, who saw it in Yungching: "Having purchased this tea brushwood, the manufacturers proceed to make it up for the ignorant Tibetan, as they themselves call him. The leaves and twigs already sun-dried are steamed in a cloth suspended over a boiler. The mould stands close by, four stout boards set up on end and secured with bitts, the interior having a section of about nine inches by three-and a-half. Inside it is placed a neatly-woven mat basket somewhat smaller in section than the mould; the steamed and softened leaves with the finer twigs are dropped into the cavity by small quantities at a time; and, a little rice water being added to agglutinate the mass, it is consolidated by layer after layer forcible blows from a wooden hammer shod with a heavy iron shoe. The coarser sticks are dried and ground to powder, and interspersed *ad libitum* among the conglomerate of leaves and twigs. The basket, being flexible and a little smaller than the mould, keeps the cake from taking the angular shape which it would otherwise assume; the corners being rounded off it is less liable to injury from the hard knocks it will have to encounter on the road to Thibet. The mould is taken to pieces, the cake with its mat envelope is brought back to the fire over which its composition was originally steamed and, when it is thoroughly dried, the ends of the envelope are closed up, and the long narrow package is ready for transport. On arrival at Ta-chienlu in the cakes are cut into portions, which then receive the name of 'bricks' and are repacked. Brick, however, is hardly an appropriate term; they are rather clods of not very closely matted foliage some nine or ten inches by seven, and three inches thick, containing a good deal more stick than leaf."—*Englishman.*

Professor Axe, Consulting Veterinary Surgeon, England who, at the request of the British Dairy Farmers' Association, is making an inquiry into the circumstances relating to an outbreak of diphtheria said to have arisen from milk retailed by a dairy farmer, has made the following preliminary report:—"Pending a full report of my investigation, I desire to say before the Association some of the most salient facts concerning the outbreak in relation to the milk distribution of the suspected dairy. The disease in question first appeared in an epidemic form on the 10th of October, when it suddenly broke out in several centres of the village. Fresh cases continued to arise day by day until the 14th, when the spread of the fever suddenly ceased. Early in the outbreak, milk from the dairy of Mr. H., of Park Farm, was regarded with suspicion, and its use in the houses of the afflicted, and also in many others, was at once discontinued; not, however, until the malady had shown itself in 30 families, of which 70 members were attacked, and 15 have since died. I visited the firm of Mr. H., and gathered from him that his business exteneds over a large area of the parish

and that his milk was regulary supplied to 95 households, divided among gentle people, tradesmen, and cottagers. Of this number, diphtheria had shown itself in 30, and I subsequently gathered that the malady had not appeared in any family to whom the milk had not been supplied, or in any person who had not partaken of it, either at home or abroad. So far as I could learn there were no cases reported in the dwellings of those supplied with milk from other sources, and, with few exceptions, all the cases occurred in the houses of the wealthy, where large quantities of milk were being daily consumed. With regard to the dairy, the cow-sheds, the cows, and the water employed in or about the house. there does not at present appear to be any reason to suspect either of them as being concerned in contaminating the suspected milk. One person on the farm, who is said to have suffered from scarlatina in June last, has been pointed to us as a possible source of infection, but I do not find anything in the nature or the history of his case to connect him with the outbreak in question. The family of Mr. H., the men on the farm and their families, had, prior to my visit, undergone a searching examination at the hands of Dr. Lorrimoor, the Medical Officer of Health to the Rural Sanitary Authority, and all were found to be free from conditions calculated to lead to milk contamination.

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"In seeking for possible causes of diphtheria other than that of milk, attention was naturally directed to a consideration of the general water supply of the parish, and the existing system of drainage and sanitary appliances, but, nothing could be found to connect either the one or the other with the origin or propagation of the fever. As to the source whence the milk at Park Farm derived the infecting principle, no definite conclusion has yet been arrived at. It may, however, be remarked that, in the course of my investigation, certain facts were brought to light which are of the highest interest to the inquiry, and point to a possible solution of the question. In this connection I found that during the present year only one case of diphtheria had been reported in Frimley. This occurred during the last week of September, in the person of a boy living at Frimley Grove, a little over half a mile, as the crow flies, from the suspected dairy. Frimley Grove comprises a small group of cottages situated on rising ground, about sixty yards distant from a stream, which, after running a somewhat circuitous course, passes through the meadows of Mr. H., in which the cows have been regularly pastured. To this stream they had access, and from it their daily supply of water was chiefly derived. Attached to the cottage in which the sick boy resides is a garden about fifty yards in length sloping sharply to the watercourse. In the middle of the garden stands a privy, and having regard to the lightness of the soil, and the sudden fall of the ground from it to the stream, contamination of the water by percolation of the sewage through the soil seems a not unlikely result. Moreover, I was informed by the mother of the boy that although everything removed from him during his confinement to the house was buried in the garden, the closet was afterwards used by him; and, further, that during his illness she had been in the habit of fetching her water for domestic purposes in pans which were used in and about the dwelling, thus exposing it to direct contamination. Whether the infecting material found its way into the stream by one of these channels, and thence into or on to the cows, to be finally mixed with the milk, is a question of the highest importance, and to which I propose to devote further attention. The result will be laid before the Council so soon as I have completed my investigation. We draw the attention of the Health Officers of Calcutta and other Municipalities of India to the above very interesting report extracted from a first class Agricultural Journal of England.

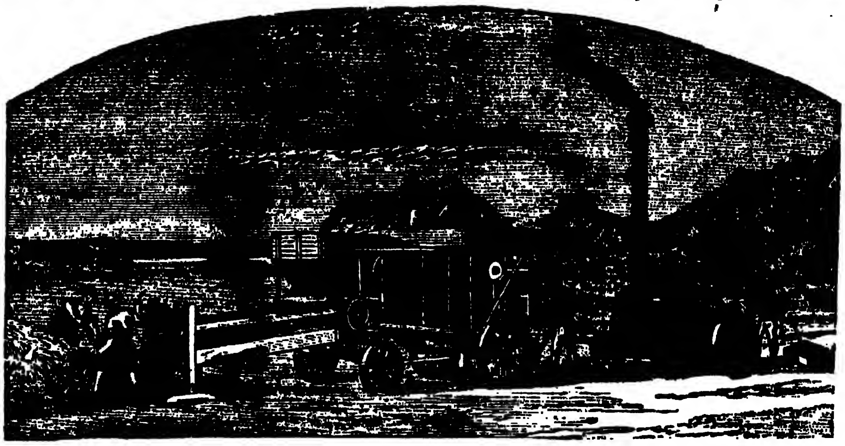
1. Harvest Report for 1885-86 by the Director of Revenue Settlement and Agriculture, Madras: From the Government of India.
2. Reports on the Exhibitions of Silk-cocoons held in May 1886 at Pathunkot and Nurpur: From the Government of India.
3. Returns of the Railborne trade of Bengal during the quarter ending the 30th June 1886: From the Government of Bengal.
4. Forecast of the out-turn in the Central Provinces of the Cotton Crop now on the ground i. e. 1886; From the Commr Central Provinces.
5. Forecast of the Cotton Crop in the Central Provinces for 1886-87: From the Government of India.
6. Report on the Railborne Traffic of the Central Provinces for the year 1885-86; From the Chief Commissioner, Central Provinces.
7. Memorandum on the Prospects of the Burma Rice Crop for October 1886: From the Government of India.
8. Report on the External Land Trade and the Railborne Traffic of the Bombay Presidency for the year 1885-86; From the Bombay Presidency.
9. Returns of railborne Traffic of the Central Provinces for the quarter ending 30th June 1886: From the Chief Commissioner, Central Provinces.
10. Report on the Progress and condition of the Government Botanical Gardens at Saharanpur and Mussorie; From the Director Department of Agriculture and Commerce, North-Western Provinces and Oudh.
11. Journal of the Agricultural and Horticultural Society of India for October 1886: From the Society.
12. Punjab License-Tax report for 1885-86; From the Punjab Government.

Thanks of the Editor are recorded for the above contributions.

STEAM THRASHING AND STRAW CHOPPING MACHINERY,

BY

RANSOMES, SIMS AND JEFFERIES, LD., IPSWICH.



Now that the necessity for the employment of Steam Thrashing Machinery in the large wheat producing countries of the East, and especially in India, is daily becoming more and more recognised, it seems an opportune moment for drawing special attention to these machines and the advantages they offer.

Messrs. Ransomes, Sims and Jefferies, LD. of the Orwell Works, Ipswich, stand out prominently amongst the pioneers of Steam Thrashing Machinery, and it is acknowledged on all sides that to this firm is due the adaptation of Thrashing Machines to the special requirements of hot countries. It is well known that on account of the absence of hay in India, Egypt, and other hot countries the cattle are fed with straw and it was therefore impossible to introduce steam, or animal power Machinery for thrasing the grain, unless it could be fitted with an apparatus which would chop and bruise the straw for fodder as it thrashed the grain. The straw grown in these hot countries contains a larger amount of saccharine matter, which renders it much more advantageous for feeding than straw grown in colder climates, but at the same time it contains more silica, and being thus harder and of a more woody nature, cannot be converted into fodder in the same way as the softer English straw, without tending to damage the mouths of the animals masticating it, through its hardness and the sharp edges which would be produced by cutting it with an ordinary Chaff Cutter. In these hot countries from time immemorial the process of thrashing has been performed by treading out the grain from the straw by driving bullocks over the corn, as it comes from the fields, placed upon a mud floor. This, in addition to the thrashing, left the straw in a soft and macerated condition. In 1863 the late Mr. John Head, of Ipswich, at that time a partner in the firm, took out a patent for an addition to the Thrashing Machine of an apparatus for chopping and bruising the straw in the same way as when trodden out by cattle. The operation is effected by passing the straw into a hopper placed at the end of the Thrashing Machine, in which are two rollers revolving at a high speed. The upper one is fitted with a series of sharp knives, shaped something like a shark's tooth, revolving in connection with a concave fitted with exactly similar teeth, so that when the straw falls upon these knives it is cut into pieces about 1½" to 2" long. The lower roller upon which the cut straw is delivered, is fitted, as well as its concave, with blunt rectangular projection, and these have the effect of softening the straw so as to render it easy of mastication. Thus is secured exactly the same result as when the grain is thrashed out and the straw bruised by horses, but both are kept clean and free from dirt and and other impurities, which are necessarily attendant upon the old system. In the same year, i. e. as early as

1863, Messrs. Ransomes sent some of these thrashing and straw chopping machine into Egypt, where they met with great success; in fact, being the only description of machine able to answer the requirements of hot wheat-growing countries, their demand very soon became general from all parts of the world, and from the date of their introduction down to the present time, Messrs. Ransomes' Straw Choping Thrashing Machines are largely in use in Spain and Portugal, South Italy, Greece, Turkey, South Russia, Asia Minor, Algiers, Mexico, Chili and other countries.

On account of the extensive agricultural districts in India, which market Messrs. Ransomes at once appreciated, they turned their attention many years ago to the adaptation of their machines and implements for that country. From the unwillingness however, of the natives of the country to the introduction of new machines, and their tenacious adherence to the primitive tools in use for centuries, considerable difficulty was experienced in the introduction of improved English machinery, but having had already much success with their Portable Steam Engines and horse Power Thrashers, Messrs. Ramsomes did not lose any opportunity of bringing their Steam Thrashing and Straw Chopping Machinery under the notice both of the Government and the agriculturists, of the country and as early as 1871 they sent out one of their already well known machines whic his believed to be the first Steam Thrashing and Straw Chopping Machine ever used in India. Other machines have since been sent to the same country. This invention, thus originally introduced by Messrs. Ramsomes, has been constantly adhered to, and has been since adopted with more or less success by all the principal makers in England.

Our engraving represents a set of Messrs. Ramsomes' Thrashing and Straw Chopping Machinery at work, driven by a portable Steam Engine, which latter can be arranged for coal, petroleom, or wood fuel, or may be fitted with Heod Schemioth's patent aparatus, for burning straw, thus enabliug steam power to be advantageously applied in every quarter of the globe. We may mention in conclusion that the results obtained by these machines in practice have shown that they are much more economical than the old system of treading out the grain. The farmer is enabled to thrash a large quantity of grain in a short space of time and without the immense loss which has always attended the method hitherto employed, in addition to which he obtains a better price for his grain owing to its being perfectly clear and of a uniform sample, and the cattle also thrive better on the straw chopped by the machine, on account of its freedom from dirt.

The Treatment of Cattle in Health and Disease in Bombay.

In describing the treatment of Cattle in the city of Bombay as practised by the natives of the country, we can divide them, for the sake of convenience into two classes viz :—

I The Draught animals.

II The Milk-producers.

Class I.—Bullocks are chiefly employed. Male-buffaloes are not used in Bombay except in preparing Chunam for building purposes and such other work where a strong and steady pull is required and time is of no concern.

Several breeds of bullocks are to be seen in Bombay. Most of them come from the Deccan. Gujarat produces five races of cattle but unfortunately they do not stand the hard, metalled roads of Bombay and soon go lame. The Bombay municipality employs a large number of bullocks at present numbering between 1500 and 1600. The municipality buys the stock principally from Poona. The cumbrous, hardy, strong, sluggish-looking, deep-chested, white coloured breed of bullocks chiefly employed in dragging the heavy municipal carts, is however not the produce of the Deccan. Young animals of this breed are brought to Poona from Malwa and Indore by Vanjárás and sold to the kunbis who rear and work them

for 3 or 4 years and sell them off when 7 or 8 years old. The brindled (black and white) bullocks are natives of the Konkan. They are longer in the stride and faster in their movement than the animals of the former breed. They are principally seen in carts. Hack-drivers employ a diminutive breed, which though small is faster in proportion to size than the larger ones.

There are generally two pairs kept for every small cart and one for the larger one. Bullocks in low condition are sent out for grazing during the monsoon when the season in Bombay is also slack. Bullocks are fed on chenna (common gram, cicer arietinum) and oorud (black gram, Phaseous mungo.) They are shod as often as the shoe wears out. A shoe lasts according to work from 3 weeks to 3 months.

A pair of bullocks at present costs from Rs. 125 to Rs. 175. The price has risen of late years. The buying season begins after the monsoon is over. For private owners, Bombay is the best place to buy bullocks as hundreds of animals are every year brought to the "Dammies" or stables to be sold and a good selection is possible.

Class II.—In the Second Class i. e. Milk-producers, she-buffaloes are mostly employed. Cows are not to be seen in dairies, but as Bunias and Bhatias consume a large quantity of milk, there is generally at least one cow in a well-to-do family. I shall therefore treat of she-buffaloes only and exclude cows which do not form any important part in the dairy trade of the town.

The milch animals are tied up in stables or dammies, no yards or boxes being in vogue. The Municipal rules and regulations are stringent and building of a damny costs a large sum of money as the drains are to be joined with the street drainage. Under the circumstances, stabling of milch animals is costly and uncomfortable. The flooring is to be made of paving stones and she-buffaloes who have roamed on soft pasture grounds in the country do not thrive well over it. Besides at the time of labour, they do not get a firm hold of the ground and often cannot exercise the full and proper strength to expel the fœtus. The space allowed to each animal is very small (2′ 6″ to 3′ × 5′ 6″ to 6′) They are tied up by the head and an open drain runs in the middle. Rs. 1¼ is paid as rent per month per head; besides 6 annas per month for the use of a well for bathing a buffalo daily. The well is not always situated in the Damny. Buffaloes come chiefly from Surat, Jaffrabad, Kutch madni and of late years from the north of India. The "Delhiwans" (that is all those that come from the north) are considered the best, the "Kutches" and the "Jaffries" come next.

DELHIWAN.

The head of the Delhiwan is short, the horns small and curved inwards. The expression of her eye is tender and lively. Neck is moderately long and thin and enlarges symmetrically towards the shoulders. The trunk is "wedge-shaped". The hind quarters are set wide apart, giving plenty of room to the capacious udder which is seen well from behind. The milk-vein is well developed. The legs thin but strong and carry the enormous weight very easily. The skin is peculiarly soft, thin and elastic. Temper is perfectly docile like that of the Jersey cow. They are sold in Bombay from Rs. 200 to Rs300; and yield on an average 15 to 20 seers (nearly half Bombay maund) of milk per day. They require greater comforts of life than the animals of other breeds. Of late years they are largely imported into Bombay on account of the high prices they fetch. The Railway expenses come up to about Rs. 60 a piece from Delhi or Ajmere to Bombay.

JAFFRABADIES OR JAFFRIES.

The Jaffrabadies or Jaffries come next. They are also very much liked on account of their milk yielding capacity. They are not so fine looking animals as the Delhiwans. Their trunk is deep and legs short. They are easily distinguishable from the nature of their horns which are long, wide set, apart and curve backwards and inwards. Their udder is large but their skin is not so fine as that of the Delhiwan. They are sold in

Bombay from Rs. 150 to Rs. 225. Good milkers yield on an average 15 to 18 seers of milk.

The Kutches resemble the Delhiwan in appearance but are smaller in size. Their horns take a spiral turn like those of the Black-faced Highland sheep. They have a remarkably mild disposition and yield on an average 12 to 16 seers of milk. They fetch almost the same price as the Jaffries.

SURTIES OR SURTANS.

The Surties or Surtans are small sized animals and yield a much smaller quantity of milk. For this reason they are not much liked by the town dairyman because grater number is required to obtain the same quantity of milk than when members of the above named breeds are kept. They are small in size and their horns are straight with their points turning inwards. They yield from 8 to 12 seers of milk and are sold from Rs. 75 to Rs.125. The buffalo bears its first calf at the end of the 4th year.

The young ones of the buffalo look ugly. They are of no use to the dairyman ; so are sent off to the Pangarapore, if alive, at the end of a fortnight or three weeks. They generally die within this time on account of want of accommodation and starvation. The period of gestation in the buffalo is about 10 months. The period of lactation from 7 to 9 months. If the buffalo takes the bull early enough, she goes dry for 3 months. If she is not expected to calve so soon, she must be either sent off to the country or sold off, because looking after and feeding animals is costly, laborious and troublesome.Poor dairymen have generally to adopt the latter alternative ; and it is for this reason that they do not seem to thrive in a trade which is apparently a paying concern. Dry buffaloes fetch a very small price from Rs. 40 to Rs. 75 for the larger breeds. Buffaloes are fed twice a day, that is, at the time of milking.

Grass forms the heaviest item of expenditure. Its price varies considerably. Hay is not stored because there is neither the money nor the space for it. The following are the substances generally given to milch-buffaloes :—

Chala of toor i. e. toor-husk (cajanus indicus.

Bran.

Bajri.

Chala of wheat i. e. the covering of wheat grains before bran is removed.

Kunda of rice i. e. the coat of rice grain immediately under the husk and to be obtained in the steam flour mills.

Oilcake of til (Sesamum indicum).

Oilcake of cocoanut.

Kapasia i. e. cotton seed.

A mixture of some of the above foods is given twice a day ; once in the morning between 4 and 6 o'clock and once in the afternoon at 2 or 3 o'clock. The mixture is kept in water for some time before being given.

The wholesale price of milk in Bombay is Rs. 4 per maund. A Bombay maund of milk is about 6½ Imperial gallons. To obtain the former amount, the producer binds himself to the sweetmeat-maker to supply him a certain quantity at his shop every day in the morning and the evening at specified hours all the year round. The milk thus supplied is unadulterated with water. Milk is sold in retail to private customers at their residences ; and also in large quantities at the Byculla Bazar. At the latter place the price fluctuates considerably. It will be seen that the difference between the wholesale and retail prices is very small. In England the middleman supplies the milk to the customers at nearly double the price at which he buys from the farmer. Both in England and in India retail milk is fearfully adulterated with water. In Bombay sugar and water are generally added to the milk. This way of adulterating preserves the natural consistency and the sweet taste of the milk.

DISEASES.

The drugs in the Pharmacopœa of the country cattle practitioner,are not so many as to be found in the country system of human practice. There are men who have indeed considerable knowledge of the cattle diseases and who are consulted by the stock-owner

when his own remedies fail. These men of course do not reveal their craft to inquirers, because they have to make their living thereby. In diseases requiring surgical operations and in cases of the diseases of the internal organs which are revealed to the veterinary surgeon by the process of auscultation &c., there is no native remedy except the actual cautery applied to the part which feels tender. In cases of fractures and dislocation, there are indeed clever bone-setters in the mofussil especially among the Vanjàràs. The low prices of animals preclude any lengthened mode of treatment and hence I believe the extreme mode of cure as the actual cautery. Blood-letting which was so common in England is not practised in India except in a few diseases. There are two methods of castrating animals. The one is that of pounding the testicles and the other method is practised as follows :—Two round iron bars are held closely together over the spermatic chord by an assistant; the operator then pushes or draws the testicles, one by one through the iron bars. This operation is performed 2 or 3 times. The former method takes a very long time and is very painful to the animal, but the latter method appears to me to be very easy and simple in practice and does not cause pain to the animal as might be supposed by any one who has not seen it performed; besides no wound is inflicted and so there is not much trouble afterwards.

WOUNDS.]—Two kinds of wounds are principally to be seen viz :—

I. Bruises.

II. Punctures.

The former are caused by bad falls and the latter by poking of bolus &c.

TREATMENT]— Turpentine, kerosine oil and tar are the principal remedies. Turpentine and kerosine oil effectually stops flies settling on the wounds, while tar checks the terrible ravages of hungry crows.

Simple opthalmia or inflammation of the eye is caused either by external injury as blows, &c. or by the presence of a foreign and irritating body.

SORE EYE.]—Symptoms :—Eyes red and water tickling down from them. They are also kept partially closed to avoid light.

Treatment]— A mouthful of salt or tobacco is chewed and the mixed saliva is carefully spit into the affected eye for two or three days. Some people also recommend "Sindoor" (oxide of lead) or a piece of porcelain finely powdered and blown from a bamboo pipe into the affected eye or eyes. If the sore eye is caused by catarrah or cold which is known by the general ill-health of the animal accompanied by the above-mentioned symptoms, sweet oil is rubbed over the poll, forehead and the horns. If the sore eye does not improve within a fortnight or three weeks, the temporal vein is fired just near the eye.

NECK-GALL.]—A large number of cases of sore neck occur in Bombay on account of negligent yoking. Improvement in the system of yoking is therefore desirable. Neck-galls are chiefly caused by ulcers, scurvy skin, abscesses under the skin, fibrous tumours and sprains of the muscles of the neck and the legamentum nuchæ.

TREATMENT]—Generally at first Sindoor (oxide of lead) and oil are applied over the sore neck. Some apply tar instead. Of course the animal cannot be worked while its neck is sore and in cases of slight sores and sprains, the animal becomes fit for use after. A large abscess which has come to a decided head and under which puss may be felt easily is opened up by piercing a hot nail. In the case of a sprain the swollen part is fired. A gentleman assured me that the bite of a scorpion over the swollen part (khadah avavi) cured the disease very soon and very effectually.

ITCH.]—In cases of skin diseases as mange, eczema, &c, kerosine oil forms a very good remedy. If the animal is taken care of i. e. bathed daily and kerosine oil regularly applied every day, itching and scales disappear after a short time.

BROKEN HORN.]—Very many cases of broken horn occur. If as soon as the horn is wrenched off, sindoor (oxide of lead) and oil are

applied and then a thick coating of dry sindoor is put over it and the whole covered over and tied up with a piece of cloth, there is very little chance for worms to appear as they otherwise will do in large number and in a very short time. This treatment must be repeated every two days after thoroughly cleaning the broken end. Turpentine is applied in the case of worms appearing.

HORN DESEASES.]—In the case of horn-disease (Bhiroor), the horn becomes loose in its root and worms are seen after a time creating ant from within, without any apparent injury to the horn from outside. The only treatment followed is cutting off of the horn and healing the cut surface as in the case of broken-horn.

LAMENESS.]—Lameness is a general symptom caused by many diseases such as sprains of the ligaments and tendons of the feet, bad shoeing, dislocations and fractures.

In cases of lameness firing is most generally resorted to. Firing in cases of lameness caused by sprains is not altogether a bad remedy; but it is generally done too soon, that is to say, before the tenderness of the sprained part is removed: and also in most cases is by far the most stringent remedy. In cases of dislocation and fractures, firing is very beneficial because it acts by tightening the skin and thus bringing the two ends of a fractured bone together. Rheumatism is considered the common cause of lameness, and as is the case with English grooms, the shoulder or the hip joint is wrongly supposed to be the seat of injury in many cases. In slight cases of sprains, hot water fomentations are resorted to twice daily. Some place the animal in a running stream or walk it in the sea when the tide is up. Some say that fomenting with water in which ant-earth has been boiled hastens the cure.

RHEUMATISM.]—Lameness is generally attributed to rheumatic pain (Sandhi wah) in some one of the joints of the leg. The animal is bathed with hot water. Camphor and oil are also applied externally.

INDIGESTION.]—If the animal suffers from indigestion, tonic balls, made up of various kinds of spices, (stomachics and aromatics) are given. Such as the following:—

Bhang (from Cannabis Sativa) ½ seer; Karijiri ¼ seer, the achenes of Vernonia anthelmintica; Inderja ¼ seer (Wrightia antidysenterica); Sanchar ¼ seer. Made up into two balls and given twice a day. They are to be repeated if necessary.

Hoven.]—Tympanitis or hoven (Dil-foog-voos) is a very common complaint, and remedies suggested are also many. Many animals die very soon of suffocation. The following are some of the remedies suggested:—

I. The affected animal is given mowa (country liquor) or rum and made to run up and down a road with a stick in his mouth between his teeth held by a man.

II. Lime-water is given to drink.

III. Onion juice and mowa are given internally.

IV. The juice of the bark of the tender boughs of the Nim tree and rum are given internally.

V. Gooraks (prepared tobacco ball for smoking in the chilam) and rum are given internally. This is a special remedy in the case of flatulent colic in the horse.

VI. In the case of the buffalo in addition to the lime-water, salt is sprinkled over the back and rubbed hard with the sole of a shoe until blood comes out.

MALIGNANAT SORE THOAT.]—This disease runs its course very rapidly. The throat becomes swollen; the animal droops and soon dies of suffocation. It is contagious in its nature but is not thought of so by the people of the country.

TREATMENT.]—The swollen throat is fired as soon as it is made known.

SMALL-POX.]—Small-pox is not supposed to exist among cattle. But cow-pox (Veriola Vaccina) does exist. It is known by the names of "sayer" or "sayer mata".

SYMPTOMS.]—At first there are abundant irruptions which together with the mouth have a strong fishy smell. The pustules which are in appearance like those found in

human subjects, appear all over the body but especially under the belly.

There is a system of inoculation prevailing among the natives. The healthy animals are given internally, in food or in the form of a ball, the pus from the pustules of an affected animal. The healthy animals are thus supposed to enjoy an immunity from the future attack of this disease.

TREATMENT.]—The animal is given cooling drinks such as toor (cajanus indicus) and ghee or ghee alone or an infusion of Jira (cumin seed) and sugar candy; or katira (gum obtained from Cochlospermum Gossypium) is soaked in water for some hours and given internally.

APOPLEXY.]—(Mathe lohi chadvoo). This disease generally appears at Diwali time *i. e.* in October-November. By this time the cattle that have been sent to the country to be grazed have returned. These full-fed animals when worked under the heat of the sun become affected with this disease.

SYMPTOMS.]—The principal symptoms by which this disease is known are two—namely, I. The ears become cold as ice, and II. the affected animal does not twitch the skin when one passes one's hand over its back as a healthy animal does. The animal is bled at once by opening the facial vein; and inhalations of the smoke of the saw-dust of black-wood are given. The disease generally proves fatal.

ULCERATED TONGUE.]—(Jibh per jadoo or kata). Vesicles and ulcers appear on the back part of the tongue. The patient becomes unable to chew solid food and hence if the ulcers continue long the patient becomes greatly emaciated.

TREATMENT.]—Rub with hand halad (turmeric powder) and salt for two or three days. Sometimes an ulcer perforates the palate of a she-buffalo; and then in the act of drinking, some of the water flows out by the nostrils.

TREATMENT.]—Take a dry tender bough of a *nim* tree (can be had at the grocer's), wrap round it a silk thread, insert it in the ulcer and seal over its mouth with opium. The ulcer under this treatment is said to heal up in time without giving further trouble.

INFLAMATION OF THE UDDER.]—Mammitis. A Quarter or half of the udder becomes swollen and hard.

CAUSE.]—Pressure of the animal over the udder while she is seated, or the dirty condition of the floor, the udder getting soaked in decomposed urine.

TREATIMANT.]—The following mixture is given for four days.

Camphor	1	℔.
Tamarind	1	„
Sugar	4	„
Water enough.		

Camphor alone may be given inserted in a plantain, or ghee is given in doses of a seer a day or a thick infusion of gum arabica. Hot-water fomentations are also applied to the inflamed udder. If blood collects inside it is drawn out.

PREMAMURE LABOUR.]—If the she-buffalo shows signs of premature labour, she is given cooling food such as "oorud-michuni" (the husk of blackgram) mixed with the leaves of "mhendi" (Lawsonia alba) or the expressed juice from them.

STRAINING.]—As soon as an animal shows signs of straining, a truss is applied in a very neat fashion and of the same pattern as is shown in Dobson's book on "The Ox". The animal is tied up in front and a pit is dug under the fore-feet to keep the hind extremities high up in order to prevent the inversion of the vagina or of the uterus. In the buffalo these complaints (Invagination and Prolapsus uteri) are not of usual occurrence. The protruded portion is replaced but the patient seldom recovers. Cooling food as ghee or infusion of gum arabic is given or both, one given mixed for 4 or 5 days. In the case of this disease great loss is sustained. She does not afterwards milk so well and there is the fear of its repetition at the time of the next delivery.

CONTAGIOUS DISEASES.]—The contagious diseases most common among cattle in the Bombay Presidency are Rinderpest and

Foot-and mouth diseases. The former is known by the names of cholera, marki, mota roge (the great plague); the latter by the names of kharmat when the feet are attacked and navasso when the mouth is attacked.

Rinderpest proves very fatal, but the foot and mouth disease but seldom so. Still the difference in the valuation of the stock before and after an attack of foot and mouth disease is indeed very great.

Toddy is believed to be beneficial in rinderpest. In foot and mouth disease a mixture of white of eggs, tamarind and smoke is applied to the vesicles in the mouth, and for the digits the affected animals are made to stand in a salt water pond where the fish called "laivty" abound or the mud from such a pond is put over the affected feet. Dung and urine of horses are also recommended by some for the feet.

The injury done to agriculture by these contagious diseases is indeed very great. The worse thing is that the mode of prevention or the eradication of the "contagium" is not known to the cultivators. And thus if a contagious disease makes its appearance in a locality, it goes on lingering and spreading year after year until in the season of scarcity it makes a clean sweep of the already enfeebled stock. Rich cultivators may not feel the loss so much as the poor cultivators, but then they dread the repetition of the attack of the disease so much, that they dare not increase the number of their stock and would rather allow their lands remain uncultivated. I know that round about Bhilad (some 120 miles from Bombay) Rinderpest has appeared here and there and now and then for the last five years. A Parsee cultivator, not at all well-off, lost 65 heads of cattle year before last. In consequence of there being no chance of replacing the lost animals except by incurring a large debt, he wisely gave up cultivating a large portion of his holding.

All interested in agriculture will sincerely hope that the government of India may follow in the wake of all other Governments of civilized countries of the world and do all in its power to lessen the mischief done by contagious diseases and thus help the poor cultivators in the direction in which they are absolutely unable to act without the help of the Government.

P. R. MEHTA, M. R. A. C.

INDIAN SILK CULTURE.

At the colonial and Indian Exhibition, a paper on Indian silk culture was read in the conference room on the 24th of June last by Mr. Wardle of Leek with whose name the readers of this journal are already familiar. He had been to India last winter. He therefore speaks with Indian experience on the subject added to his English experience of silk dying extending over a long period of time.

The great variety of fabrics of which silk comprises, if not the whole, the most important part, has been roughly stated to be the Corah silks of Bengal, rudely produced by looms that would raise the smile and wonder of Europeans, the coarse Tussur fabrics woven in the same and other districts, the magnificent kinkhabs of Benares, Ahmedabad and Surat, in which gold and silver form such important decorative features, the plainer silks of Delhi,and the delicate and beautiful silks of Thana (a very ancient Christian Settlement) manufactured by a curious and isolated race of weavers. In the sixteenth century there were 4000 weavers at Thana, but now there are only seven families with fourteen looms. The rich fabrics of Yeola, situated not very far from Thana, the lovely brocades of Surat, incomparable for living beauty and Arabian grace of design, the ruder though not less interesting silks of Peshawar and the surrounding country, the satins of Azimgarh, Ahmedabad, Surat, Dhrangdhra and Kathiawar, the wonderfully constructed patterns of the Patolo weaving with 'tie and dye' warp and woof, the silks of Behrampur, Cambay, Cutch, Indore, Kathiawar and Bombay, all testify to the skill achieved by Indian dyers and weavers during many ages.

The printed silks of India, too, are by a long way not the least of her interesting decorative work. It is a great pity that anything should have superseded the parmanent and striking prints of the old-fashioned pocket-handkerchiefs. "I have seen them",says Mr. Wardle, "being printed on the squat tables of the Calcutta printers, with indescribable interest, who use their prettily sculptured little blocks with a dexterity and exactness marvellous to see, requiring no pin points to guide them in their repeats of patterns."

For ages, and so long as they continued to use the natural colours which they obtained from their own beautiful dye-stuffs, coupled with an ingenious and traditional taste, they never could go very far wrong in colour. "It is now impossille to observe without great regret in passing through India how the love of the modern brilliant European dyes has affected to a serious degree the products of the Indian loom of to-day."

This is also to be observed as much in another part of silk decoration in India which is as extensive, if not more so, than weaving—viz, the ornamentation of fabrics of cotton, wool, and silk, by embroidering with a silken floss or thread. Embroidery in India is on a great scale, much of it unknown because unseen. The ladies of Assam, for example, embroider most beautifully, not for sale, but for domestic uses and for marriage and other presents. It is purely carried on as an art, and not for commerce, and it is principally done with a silk that will one day be in considerable demand in Europe—that is, the silk produced by the worm of the *Antheraea Assama*, or the Muga silk-worm. It was not known to the English until recently that any of this silk was exported. It has often been stated by observers in Assam and India, that it was only produced for home consumption, but when Mr Wardle was in Calcutta making inquiries about this silk, which has engaged his attention now for several years, Sir. F. C. Buck and Mr. H. Z. Darrah, Officiating Director, Department of Agriculture, Assam, discovered, whilst on a tour of inspection and search in the bazaars of Calcutta, that the embroidered turbans made in Dacca were worked upon a cloth of cotton and Muga silk, wholly embroidered with undyed silk of the same kind. This embroidery, which had been very well known as having been sent down to Calcutta, and largely worn there by the people, and also exported into Arabia and other parts of Western Asia, but kept, in the hands of a very few merchants, was previously thought to be worked with Tussur silk, the fawn-like colour of which it closely resembled.

India can boast of the greatest silk-producing fauna in the world. She has her varieties of Bombycidæ which feed on the mulberry leaf, both wild and domesticated; she has her jungle broods of worms of many sorts, more or less useful or to become useful by-and-bye; the Tussur silk is now an established and well-rooted industry, a few years ago in exports non-existing; the Assamese women are clad in silks of the Eri and Muga worms, of which as yet the Europeans know practically nothing; and silken stuffs are handed down from matron to spinister but little the worse for the wear of a generation.

India sends to Europe but very little raw silk now. It was only 457,600 lbs. in 1885. In 1874 it was 2¼ million lbs, and in 1870 2½ million lbs, against an annual export from China to Europe in 1883 of 7 million lbs., and from Japan of 3 million lbs. Just a hundred years ago, Indian silk was so good in quality as to drive out all competitors from the European market, save China and Italy. In 1844 it was so bad that European manufacturers could not buy it; it had gradually lost its reputation from want of quality. But the silk itself, that is, its fibre as it rested in the cocoon, had not altered in these hundred years, but the method of manipulaton, namely, the reeling of it from its cocoon, had not kept pace with that of other countries; it had in fact fallen back, gone worse, until Indian silk almost found no place in the world's market; and more, even the manufacturing people of India would not buy it. In a few of the Bengal districts, such as Murshidabad and others, it is used for weaving Corah silks, but generally over India it is not to be found. The manufacturers of Poona bought China silk because Bengal silk was of such defective quality. "From the Deccan to Calcutta, and from Calcutta to Benares and on to Peshawar," I found says Mr Wardle either "China or Bokhara silk; and so down Rajputana to Ahmedabad, Baroda, Surat, Yeola, and Thana, everywhere the native silk avoided, and everywhere the same reason given, its want of thread regularity."

Silk was imported in 1884-85 to a much smaller extent than in the last two previous years, only 1,831,702 lbs, which was 17 per cent. less than in 1883-84, though still a very large quantity for a country which is held to be a great silk-producing country. Whatever may be the capacity of the country for producing silk in large quantities, it is clear that while India imports more silk than it exports (the bulk of the exports being, moreover, only waste or chassam) the country must more properly be called an importer and consumer rather than a present producer of silk. Most of the imported silk comes from China and from Siam, *via* the Straits for Bombay mainly, and Burma in smaller degree. Even Bengal, however, the great silk-producing province, imported 212,349 lbs. of silk last year.

By lengthened microscopical study of the structure of Bengal and other cocoons, Mr. Wardle has come to the conclusion that the fault of Bengal silk does not lie with the worm but with the method of reeling, and that this defect can easily be remedied by using the neat little instrument brought but by an Italian and hence called after his name *Tavelette Consono*. Last winter when in India, he conducted a series of experiments on reeling with the latter machine and proved satisfactorily its efficacy and superiority over the native reeling apparatus. Some of the Bengal silk reeled by this machine has since been pronounced by experts to be fully equal if not superior to Italian silk. The efforts of Mr. Wardle

to revive the Bengal silk trade, if fully backed by our Government and properly understood and supported by the people of the country are, we are fully convinced, sure to be crowned with success. We owe Mr Wardle a debt of gratitute for this and hope to see ere'long an organized effort made to carry out the improvements suggested by him.

The silk of the Bengal worm, by its greater elasticity, is much better adapted for sewing silk than any other. Mr. Wardle has estimated, the tension of the bave, or double fibre deposited by the silk-worm, of the Bengal Madrassee or hot weather cocoons, the Bengal Desi or November bund cocoons, and of Italian cocoons. The results are shown in the following table, each figure being the average of numerous determinations, and representing the number of centimetres, which three decimetres of the bave is capable of extending before it breaks :—

	Tension at the end of the cocoon bave which is at the surface of the cocoon immediately beneath the superficial loose fibres or waste.	Tension at the middle of the cocoon bave.	Tension at the end of the cocoon bave which is nearest the telette or inner envelope
Madrassee Cocoon	4 4	6 3	5·6
Desi Cocoon			4·8
Italian Cacoon ...	2·6	4·9	3·3

In answer to an injuring by Mr Wardle, Mr Nicholson, silk manufacturer, Macclesfield, writes the following:—

"In answer to your enquiry, I consider that good Sardah raw, when well reeled with plenty of spin upon it, will work well. It will then be a good substitute for Italian, its cheapness being the reason for its use".

Mr Nicholson it must be remembered is speaking of a Bengal silk that was not reeled by the Italian method. In Mr Wardle's opinion there would be no greater evenness of thread in the Italian silk over Bengal if the Italian method of reeling were used.

Messrs. G. Davenport & Co., of Leek, to whom Mr Wardle sent a portion of the 10 to 12 deniers, which was reeled by the Tavelette Consono in Bengal, threw it into organzine and tram, and sent him the following report :—"The slip winds beautifully. Enclosed are samples of two threads tram and a 500 yards skein of organzine. The silk is very clean. We consider it equal to ordinary Italian. It was running for an hour and only broke down once."

"Now it is necessary tosay," "says Mr Wardle", that, even with every improvement, Bengal silk may not be expected to rival or supersede the finest qualities of silk in the market. An objection or two may suffice. It will never be as white as China silk, because one is from a yellow cocoon and the other from a white one. It will not boil-off or condition as well as the silks of Italy, China or Japan, because it contains more gum or gres than these, and this brings me to an entomological point, namely. it is probably not of the same species, but of this further on."

But apart from the well known firms, there remains the much larger native industry, the reeling that is carried on in the numerous villages under the shade of banyan, palm and mango groves. The appliances used by them are very rough and rude, and the reeling varying from 10 to 20 cocoons in almost as many seconds.

In the Rajshahi District alone, out of 97 filatures, 63 are native and the remaining 34 European, eleven to twelve thousand natives of the country being employed in silk reeling in this district alone, 150 square miles of which exist under mulberry cultivation.

If these village native filatures can be induced to improve their reeling, a largely extended industry lies waiting for them in their own country ; for it goes without saying that the resources of China and Bokhara would not be drawn upon if Bengal silks were of the required quality. Many native manufacturers prefer to buy Indian silk if only the quality were good enough. The consumption of silk in India alone is enormous. All Hindoos wear it at meals or worship. The Mahomedans wear Mashru, or cloth of cotton warp and silk weft, the wearing of pure silk fabrics boing forbidden by the Koran.

It may be useful here to state that the Bengal silk-worm of the rainy and hot weather bund or season is called locally the Nistry-poloo and Madrassee worm : that of the November or cold weather bund or season is called the Desi or Chota-poloo worm ; they are designated by Mr. Wood Mason respectively *Bombyx cræsi* and *Bombyx fortunatus* though perhaps only provisionally.

That there is a great future in store for sericulture in India is beyond doubt, and if only the same energy were applied as that brought to bear on the production of Indian wheat and Indian tea, the day would not be far distant when the silk centres of Europe would desire the silks of Bengal as much as they now do those of China and Japan.

Tussur silk as adapted for export, has been, during the last ten years, very slow in taking root in India, and large supplies have had to be obtained from China to meet the gradually growing European demand. At the Paris Exhibition of 1878, Sir Philip Cunliffe-Owen determined to give this silk an op-

portunity of asserting itself, and afterwerds, in the India Museum, he took care that its capabilities and uses should be conspicuously depicted. Not a little of the industrial growth of this useful though wild silk is due to his encouragement, and now in the late Exhibition was seen the fruits of all the care which has been bestowed upon it in various ways.

A number of gentlemen in India are vieing with each other to improve the methods of reeling, and with singular success. In the cases set apart for Tussur silk were shown results which a few years ago would have been thought to be impossible. Already this silk is capable of far more extended uses than ever before, and although it cannot be expected, on accounts of its structure and properties, to take the place of the more beautiful silk of the Bombycidæ it has its uses, and these in a much higher degree than it was ever thought susceptible of.

Besides the silks already mentioned, there are others, such as the Eria silk; obtained from the Attacus ricini silk-worm, which will gradually find extended utility; and great lessons will be learnt by those who cared to observe in the varied exhibits, both in the reeling of the cocoons the spinning of the waste fibres, and the dyeing and weaving of the

In the Santhal Jungles the leaves of *Terminalia tomentosa* form the food of those Tussur silkworms whose cocoons are intended to be utilised industrially. The worms whose cocoons are intended for breeding are fed on the leaves of the *Shorea robusta*, (Sal).

The prices of Tussur cocoons in Fatwa, Manbhum Gaya and Chutia Nagpur are shown in the following table (January, 1886):—

Fatwa ...	... 120 cocoons per rupee	...	Best cocoons
	160 " "	...	Comun cocoons
Manbhum	... 5 to 7 rupees for 800	...	
Gaya ...	... 10 rupees for 1000	...	
Chutia Nagpur	... 320 cocoons per rupee	...	Formerly
	240 " "	...	Recently
	160 to 200 "	...	Price which the people are now demanding

At the beginning of the year the contract price for Indian Tussur waste silk was in France 1*s* 6*d* per lb., the highest rate yet obtained, and for Tussur raw silk of the improved reeling 7*s* 3*d* per lb as against 4*s* 8½*d* per lb., for Chinese Tussur raw silk.

A few particulars of the value of Muga and Eria silks may be useful here.—

1. Muga. The silk of the Muga cocoon is reeled, not spun. The two principal trees upon which the Muga silkworm feeds are the *Soom* (*Machilus odoratissima*), and the *Sualu* (*Tetranthera monopetala*). The price for cocoons for reeling is 500 to 800 cocoons for Re. 1. The price for waste cocoons is Rs. 2 per seer containing nearly 3000 cocoons, or 1*s* 6*d* per lb. The price of Muga raw silk is from Rs. 8 to Rs. 12 per seer, or 6*s* to 9*s* per lb. Muga spun yarn can be bought Rs. 4 per seer, or 3*s* per lb The price of Muga cloth in Assam varies from Rs. 1—8 to Rs 2 (2*s* 3*d* to 3*s*) per square yard.

2. Eria.—Eria cocoons are sold at Rs. 2—8 to Rs 3 per seer, containing about 8600 cocoons, or 1s 10½d to 2s 3d per lb. Pierced Eria cocoons sell in Calcutta at Rs. 60 to 73 per maund of 82 lbs, or 1s 1d to 1s 3d per lb. Cocoons containing the dessicated chrysalis sell at the rate of 1,200 to 1501 per rupee or at about 9 annas per seer, containing 700 cocoons (5*d* per lb). The prices, however, vary much. The value of the thread varies from Rs. 4 to 7 per seer, or 3s to 5s 3d per lb. Eria thread is made of silk spun from the cocoon and not reeled, as it is not practicable to reel this cocoon. The value of Eria cloth woven with this spun thread varies from Rs. 7 to 20 for 6 to 7 yards according to quality, or 1s 6d to 5s per yard. The *Philosamia* or *Attacus cynthia* is found wild in the Terai. The *Philosamia* or *Attacus ricini* of Assam is said to owe its difference from *A. cynthia* to domestication.

The *Desi* or *Chota poloo* silkworm of Bengal *Bombyx fortunatus*), is said to have been imported from China, in 1771, by the East Indian Company, but the pure variety is now only to be found in Bogree, Midnapur. The *Madrassee* or *Nistri potoo* silkworm (*Bombyx crœsi*), is found throughout the silk districts of Bengal. It is characterised by having round and not cressent marks. The *Boro poloo* silkworm, the only univoltine variety, and others, is found only in parts of Murshidabad, Hugli, Midnapure and Birbhum Districts. It is said to have been introduced in 1710, but is gradually being neglected by rearers as precarious and uncertain. Another variety of the mulberry silkworm, known as *Chini*, is found only in Midnapur, Bengal. This silkworm, as well as the *Boro poloo*, has cresent marks. Cocoons of Mulberry silkworms for seed, purchased in different districts, are called *Sunchoo*. The mulberry feeding silkworms of Bengal have four moultings, being in the first stage black, the second blackish-grey, the third grey and the fourth greenish-white and grey. The leaves are given to the worms at first chopped up, after the third moulting detached from the twigs, and after the fourth moulting attached to the twigs. Thirty or forty pounds of cocoons are obtained from an English ounce of eggs. A *bigha* of land gives four crops of leaf in the year, and the produce of cocoons reared per *bigha* in the year is 3 *maunds*. In the Panjab

experiments from eggs of French, Italian and Japanese origin yielded 40lbs of cocoons per ounce of eggs, and that 16lbs. of fresh cocoons yieleded 1lb. of raw silk. In Europe 12lbs. to 14lbs. of cocoons yield 1lb. of silk. In Italy and in France sericulturists obtain 40 to 60 kilogrammes of cocoons per ounce of eggs, but the yields vary with locality and climate. This larger yield is the result of studying the worms, in selection of eggs, in crossing the numerous varieties of the silk-worms.

The mulberry in Bengal (*Morus Indica*), *Tut*, is grown in clayey or sandy soils as a perennial shrub. It is cut down seven to eight times a year. It is planted once and remains in the soil until it wears itself out, or the ryot finds other crops more profitable. New earth is generally put on to renew the soil. The roots belong to the ryot and not to the zamindar.

The following are the silk districts of Bengal:—Bardwan, Bankura, Birbhum, Midnapur. Hugli with Howrah and Serampur, 24 Parganas, Nadiya, Jessore, Murshidabad, Rajshahi, Rangpur, Bogra and La'dah.

NEWS

The North-Western Provinces and Oudh.

The first report on the prospects of the Cotton Crop of the North-Western Provinces and Oudh is as follows:—"Rains timely and generally well distributed in the important cotton-growing districts. Total estimated area about 10 per cent. larger than last year. Plants strong and vigorous. Flowers a little injured from the late heavy rains towards the close of August, but on the whole promising. Taking 100 to denote full average crop, present prospects estimated at 85."

Bombay Presidency.

The second report on the prospects of the Cotton Crop in the Bombay Presidency is as follows:—In the Deccan the area is 1,125,000 acres, or 150,000 acres above average, and 400,000 acres above last year's sowings. Rains timely and good. Nasik area 20,000 acres, Poona area 10 000 acres, Satara area 12,000 acres. Other areas already reported. Break in September will shorten Khandesh crop, but elsewhere crop promising, especially in Sholapur. Guzerat:—area 600,000 acres above average, but slightly below last year's area. In Broach area available 380,000 acres, Broach 200,000 acres, Surat 100,000 acres. In East Guzerat area 200,000 acres. Crop twice or thrice sown owing to washing rain of July and August. September break bad, except in Broach; crop assured there, but more rain wanted elsewhere. Baroda area 425,000 acres; Cutch 175,000 acres; reported slight decrease. Other reports from States not received. Karnatic:—sowings incomplete owing to lateness of rain; in Belgaum 150,000 acres already sown; in Kolhapur 33,000 acres. Crop thriving. Sind:—no returns.

Burma.

The report on the prospects of the Rice Crop in Burma for October 1886 is as follows:—"The estimated area under rice is practically unaltered, the present estimate showing a total increase of 681 acres over last month's figures. The weather has been reasonable in most districts, but more rain was required in Prome and has since fallen, doing much good to the crops on the high lands. In each of the three districts of Hanthawaddy, Tharrawaddy and Thongwa some 20 000 acres have been destroyed by floods. Prospects of crops are reported as generally very good."

River-borne Trades of Assam for the quarter, ending 30th June, 1886]—The main imports of the quarter into the Brahmaputra Valley were—Metals - Iron, Brass and others, Rice husked, Cotton piece goods (European), Oils other than kerosine, Pulses, Salt, Liquors, Sugar, Cotton twist and yarn (European), Tobacco and Ghi. The main exports of the quarter were Mustard, Tea, Rubber, Lac, Timber Cotton raw, Coal and Jute raw. The principal articles imported into the Surma Valley during the quarter under review were as follows:—Cotton piece-goods (European) Metals,—Brass, Iron and others. Tobacco, Sugar, drained undrained, Spices, Pulses, Kerosine, Other oils, Liquors and salt. The staple exports of the Surma Valley were—Tea, Paddy, Dried fish, Lime, Linseed, Hides and Ghi.

Central Provinces.

Forecast of cotton—The districts in which the cotton crop is of most commercial importance are Nimar, Wardha, Chhindwara and Nagpur, which contributed last year 90 per cent of the total amount of cotton exported from the provinces. It will be observed that the prospects of the crop in these districts are on the whole satisfactory. The season opened suitably for cotton sowings, and the crop was sown on a larger area than that of the preceding year. The break in the rains, which commenced towards the end of July, was also most favourable, since it permitted of proper weeding, upon which the success of the crop very largely depends. At the end of August the crop promised to be one of the best that had been gathered for many years past, but the rain continued to hold off for a longer period than even the cotton plant could stand and towards

the end of September the crop began to show signs of injury. Fortunately, however, a good fall of rain occurred in the beginning of October which immensely improved prospects, and there is now, a fair hope of gathering a crop considerably over the average, although the district reports do not take so sanguine a view as this. The exports of cotton from these provinces during the year ending March 31st last amounted in value to close upon 20 lakhs of rupees, against 10¾ lakhs in the year preceding and 17 lakhs in 1883-84. The increase was due to the comparatively good outturn of last year's crop, and, if anticipations are justified, the exports of the current year should certainly not fall short of last year's figures.

Name of district.	Area under cotton during preceding year.	Percentage by which area under cotton exceeds (+) or falls short of (—) area of preceding year.	Estimated out-turn in annas per rupee, taking 16 annas to represent an average
	Acres.		
Saugar ...	27,449	+11	9
Damoh ...	9,293	+30	12
Jabalpur ...	20,063	+12	14
Mandla	No	returns	required.
Seoni ...			
Narsinghpur ...	31,792	2	13
Hoshangabad ...	10,628	−15	8
Nimar ...	38,246	+15	13
Betul	No	return	required
Chhindwara	53,280	+ 4	9
Wardha ...	2,27,563	+ 7	16
Nagpur ...	1,24,893	+ 6	12
Chanda ...	17,307	+ 2	16
Bhandara			
Balaghat			
Raipur	No	returns	required.
Bilaspur			
Sambalpur			

Railway-borne Traffic for the year 1885-86].—The total traffic of the year is compared below with that of the two years preceding.—

	Weight in maunds.		Value in rupees.	
	1884-85	1885-86	1884-85	1885-86
Imports ...	36,07,974	45,28,093	2,86,52,722	3,64,66,040
Exports ...	1,82,74,720	1,53,79,825	3,96,65,493	4,08,32,611
Total ...	2,18,82,694	1,99,07,918	6,83,18,215	7,72,94,651

Generally then it may be said that the trade of the year under report is characterized by a very considerable increase in imports (amounting to 25 per cent. in weight and to 27 per cent. in value) and by a decline in the export of grain, which, so far as values go, is more than counterbalanced by an increase in the exports of cotton. The principal commodities which are imported into these Provinces is as follows:—Coal, Cotton twist and yarn (European and Indian,) Cotton piece goods (European, Indian), Metals—Iron, Others, Salt, Sugar (Drained, Undrained), Tobacco, Provisions, Railway-plant and Spices. The following are the principal articles of export during each of the last three years, —Coal, Cotton, Wheat Rice, Others, Hides, Linseed, Tilseed, Myrabolans, Stick-lac and Ghi.

Speaking generally, the Provinces have had no reason to be dissatisfied with the traffic which they transacted during the year under report. The seasons were if any thing unfavourable. The wheat crop, on which depends one-third of the export traffic, fell considerably short of an average. The cotton and til crops were above the average, but they are much less valuable than the wheat crop and would not have succeeded in making good the deficiency had they not been assisted by a material increase in the export of myrabolans. The total exports (judged by their value) show however an increase over those of the preceding year. The import traffic increased very greatly, and this may probably be ascribed in some part to the large balance outstanding in favour of the Provinces at the close of the previous year, when the surplus value of the exports was considerably over a crore of rupees. The balance has been greatly reduced by the increase in import, and the surplus value of the exports of the year under report amounts to less than 77 lakhs rupees.

Railway-borne Traffic for the quarter ending June 30, 1886]—The most noticeable features in the Provincial traffic of the quarter under report were a large increase in the exports of cotton and wheat, and a large decrease in the export of linseed. The exports of cotton and wheat during the quarter under report and the corresponding quarters of the two previous years were-

	Maunds.		
	1884.	1885.	1886.
Cotton ...	89,507.	6,988.	84,450.
Wheat ...	42,44,395.	31,62,951	38,64,330

The extraordinarily small export of cotton during the 1885 quarter was due to the character of the 1884 cotton crop, which owing to heavy and continuous rain was poor in the extreme. The amount exported during the quarter under report, though less than that of 1884, was satisfactory. It was mainly drawn from the Jubbulpore

and Nimar districts, and not from the cotton producing districts of Wardha and Nagpore, which had despatched most of their produce during the preceding quarter. Although the exports of wheat are considerably larger than those of 1886, they also fell short of those of 1884, when the wheat trade was in a condition of abnormal activity. The linseed exports of the quarter compared with those of the two previous corresponding quarters were:—

	Maunds.	
1884.	1885.	1886.
12,96,005	12,43,491	3,54,774

This great decrease—which represents a loss to the provinces of some 27 lakhs of rupees—is due to the wet and cloudy weather which prevailed for a great part of last cold weather, and which ruined the linseed crop. The gain to the provinces from the increase in the export of cotton and wheat was barely sufficient to cover a half of this loss.

"Some of the ugly secrets" says the *Englishman*, "of the Chinese tea industry are at last beginning to attract attention in England. An advertisement appears in a London paper for "tea colours," and is already exciting a good deal of anxious curiosity. Here it is:—"Tea Colours Wanted, by a firm in the Orient, to give tea the, in many parts of the world, desired colour. As quite a large quantity is wanted, firms prepared to offer for the purpose suitable shades, are requested to send samples, with net cash prices, to P. 96, care of Messrs. Haasenstein and Vogler, Bremen." With reference to this, Truth asks if drugs are so used, and "whether they are harmless, or whether cut-throat competition brings adulteration into even tea colours." To those in the trade, it is notorious that China teas are not only coloured with drugs, but that the drugs used are often poisonous. It is one of the strong points in favour of Indian tea that it is absolutely free from artificial colouring. If this were more widely known, it might stimulate the demand for the Indian product, the purity of which is above suspicion."

To clean Cane-seat Chairs.—Dissolve one ounce of borax in a half gallon of water, and with soap and brush scrub the cane-seat chairs well, after which turn them up side down till dry, which draws the cane tight and restores it to its natural colour.

A New Industry.—A company is being formed in Mexico to work up the Cactus plant. The oil is to be used for lubricating purposes, the fibre for cordage, the leaf for paper, and the fruit for eating. The fruit is so juicy that it often takes the place of water for both man and beast; and some years ago, when the drought came over San Luis Potosi, thousands of cattle were saved by eating the fruit.

To Remove Ink spots.—The moment ink is spilt, take a little milk and saturate the stain; soak it up with a rag and apply a little more milk, rubbing it well in. In a few minutes the ink will be completely removed.

Fattening Pigs.—The first stage of the fattening pig is that of the porker; that is, when the pig is killed, it weighs from 48 to 56 lbs., after being well fed from the time it was weaned. Pigs intended to be fed as porkers should be kept confined to the sty, their food varied occasionally, and given often, but not in such quantities as to cause any to be left over. Skim-milk or butter-milk mixed with barley meal, oatmeal, or Indian meal, makes exquisite pork. The oatmeal and Indian meal should be well boiled, and then mixed with the milk; barley-meal may be mixed with the milk or with the porridge without being cooked, and oatmeal is also sometimes given in a raw state; but pigs thrive better on those meals, or on rice, when they are boiled—at least until within ten days or so of the time when the pig is to be killed, when it may be given raw, mixed with some milk; a little pea-meal or bean-meal added will assist in rendering the pork firm. Some well-boiled potatoes may be given occasionally, mixed with milk, as a change of food, or a small quantity of pulped food with which meal has been mixed. Raw unprepared roots of any kind should not be given to porkers, or to any pig which is fattening. The food of porkers should always be given slightly warm. Porkers should be fully fat at from four to five months old.

PERIODS OF GESTATION.

By Professor G. T. Brown.

	Days.	Average.
In the mare	300 to 400 ...	340
" cow	220 to 320 ...	280
" sheep and goat	143 to 156 ...	150
" pig	104 to 127 ...	120
" dog	55 to 70 ...	63
" cat	50 to 64 ...	55
rabbit	28 to 30 ...	30

These periods vary with individuals and with breeds; with the sex of the offspring, the age of the dam, and her strength and condition. It also varies because of the length of the season of heat, for this may continue several days, and impregnation may occur some time after service, when the ovule passes through the Fallopian tube. This passage requires four to five days in the cow and sheep, and eight to ten days in the dog.

Some animals always carry their young for an abnormal period, either shorter or longer, and this habit becomes characteristic with them. The Dutch cows are said to be more regular, and to keep closer to the average period of 280 days than other breeds. A mare served by a thoroughbred horse will go longer with foal than one served by a cold-blooded horse, and a mare goes longer with a mule colt than with a horse colt; but precisely what this difference amounts to is not yet sufficiently established. The average period of gestation in the mare is 340 days. Recorded periods in 284 cases mentioned by Fleming in his "Veterinary Obstetrics," give 307 days for the shortest, and 394 days for the longest period—a mean of 346 days. In 25 cases noted at the stud at Pin, in France, the shortest time was 323 days, and the longest 367 days, the mean being 343 days. Baumeister states that the periods of pure-bred Persian mares were 338 days for mare foals and 343 for horses foals; in pure-bred Arabs they were 337 and 339 days for female and male colts respectively; in Orloff mares the average period was 341½ days, and in half-bred English mares it was 339½ days. The majority of foals are born from the 340th to the 350th day; living foals are rarely born from the 300th to the 310th day, but frequently from the 350th to the 365th day. After the latter period a live birth is rare.

It has been generally the case that the periods of gestation are shortened by the more favourable physical conditions prevailing in high-bred studs, where the keeping and the vigour are of the highest character. The period of the ass is always somewhat longer than that of the mare.

In cows the periods vary quite as much as in mares. In a French agricultural school, of 1062 observations, 5 periods were less than 241 days; 52 from 241 to 270 days; 119 from 271 to 280; 250 from 281 to 290; 70 from 290 to 300; and 32 longer than 301 days; 544 periods were from 271 to 300 days. The average is 283 days. The shortest known period is 210 days, and the longest 353. The average period of the Swiss cows is known to be 280½ days—that of bull-calves being 283 days, and of cow-calves 278 days. In 764 observations made by Earl Spencer with high-bred Shorthorns, no live calf was produced before the 220th or after the 313th day, and all born before the 242nd day, died in the attempt to rear them. The average time was 284 days. The majority of the calves dropped after the 290th day were bulls.

The *American Journal of the Medical Sciences* records, as the results of 62 observations, that the shortest period was 213 and the longest 336 days: the average for cow calves was 282 days, and that for bulls 288 days. In my own herd, the past two years, of 30 births, 6 were from 270 to 278 days, 22 from 280 to 283 days, and 2 were 291 and 292 days. The nine longest periods—viz., from 286 to 292 days—were all bull-calves. The shortest periods—270 and 272 days—were with a pure Dutch cow, and the longest with a pure Ayrshire; this cow went 291 days last year, and 292 days this year.

The average period of the sheep is 149 to 150 days. The Southdown goes 144 days only, as a rule, and the Marinos 150 days. This difference has been widely observed. Parturition may take place in the ewe from the 145th to the 160th day. The male lambs occupy the longer period. In my own flock, consisting of natives, with half-bred and thoroughbred Cotswolds, in five years' record—viz., from 1865 to 1870—the periods were remarkably regular with those sheep whose time of service was accurately noted, and these were nearly all of a flock of from 50 to 70; the shortest time on record is 148 days, and the longest 156 days. In 1870, of 65 lambs 35 were dropped on the 150th day. One ewe brought a pair of very large lambs on the 156th day; but this was a case of difficult parturition, as the ewe had been chased by a dog some time previously, and was very weak and required assistance. M. Magne mentions 429 cases, in which the periods were from 143 to 156 days; of these 329 were from 147 to 151 days, and only three went as long as 156 days. The sheep, therefore possesses a much more regular period of gestation than the larger animals. The period of the goat, is said to be somewhat longer than that of the ewe—153 days, or five months, is given by Mr. Holmes Pegler in his book "On the Goat". The only two cases personally known to me are both of 154 days, and in both the kids were males."

The time of the pig is considered as four months (120 days), or, as fancifully held by some, as three months three weeks and three days. Authorities give many observations in which the periods have been from 109 to 133 days, and the average from 116 to 120 days. In 65 cases noted by Rainard, and mentioned by Fleming, 2 were 104 days; 10 from 110 to 115 days; 50 from 115 to 125 days;

and 3 from 126 to 127 days. The average is 119 days. In my own records, for several years the periods have been exactly 120 days in every instance but two, and in both of these the pigs died. The dog's period has been noted as from 58 to 65 days Baumeister states the extremes to be 55 to 70 days; the average being 60 days. Other observers fix the average as 63 days, or the popular period of 9 weeks. The cat goes 8 weeks as the average; the extreme period as noted being 50 to 64 days. The rabbit goes 30 days, and this animal is extremely regular in its period.—Professor G. T. BROWN *in "Veterinarian" for September.*

CROP AND WEATHER REPORTS.

For the week ending 3rd November 1886.

General Remarks.—The rainfall of the past week has been heaviest in Bombay, the Central Provinces, Mysore and Coorg, and Burma. In Madras, Bengal, Assam, Berar, and Central India, and in a few places in the Punjab and the North-Western Provinces and Oudh, there have been slight showers.

The kharif harvest continues in Bombay, the North-Western Provinces and Oudh, Punjab, Rajputana, and Hyderabad, and is also in progress in the Central Provinces, where, as in parts of Bombay, the standing crops have been somewhat damaged in places by heavy and untimely rain. In Berar and Central India the crops are progressing well, and prospects are also satisfactory in Madras, Mysore and Coorg.

The rice crop in the Central Provinces is improving under the late rain, and in Bombay, Bengal, Assam, and Burma the condition of the crop is favourable.

Cotton-picking continues in the North-Western Provinces and Oudh and in Berar, but in the Central Provinces the crop has been injured by excessive rain. In Bombay cotton prospects are generally good.

Rabi operations are in active progress everywhere, and where the sowings have germinated they promise well. In the Central Provinces the rainfall still retards the rabi sowings.

The public health is generally satisfactory in all Provinces.

Prices are falling in Mysore and Coorg and in two districts of the Punjab, but are generally steady elsewhere.

For the weeks ending 10th & 17th November 1886.

General Remarks. Except in Madras, Mysore, Bombay Hyderabad, Burma and in a few districts in Bengal and the Central Provinces, there has been no rain in the country during the fortnight ending the 17th instant. No report has been received from Burma for the second week.

The kharif harvest continues in active progress in Bombay, the Punjab, Central Provinces, Rajputana and Hyderabad, and has been completed in most places in the North-Western Provinces and Oudh. In Bombay and Hyderabad the crop has suffered slightly from excessive rain, but on the whole the harvest promises well everywhere. In Madras the harvest outturn is average and the general prospects good, and in Mysore and Coorg the standing crops are reported to be in good condition. In Berar and Central India the agricultural outlook is satisfactory.

The rice crop in Bombay, Bengal, the North-Western Provinces and Oudh, the Central Provinces and in Burma has done well. In Bengal the aman promises an excellent outturn. In Assam the crop prospects are good.

Cotton-picking continues in the North-Western Provinces and Oudh, the Punjab, Central Provinces and Berar. In Bombay the crop has been injured in some places by too much rain.

Poppy sowing has commenced in Bengal and the North-Western Provinces and Oudh.

Sowings for the rabi are now well advanced throughout the country, and prospects are generally very satisfactory everywhere.

The public health continues generally good in all Provinces, except in Bengal where fever is prevalent and in Ajmir where cholera has appeared.

Prices have fallen in Mysore and Coorg, and are rising in three districts of the Punjab. Elsewhere they remain generally steady.

For the week ending 24th November 1886.

General Remarks.—Except in Madras and in a few places in Bengal, Bombay and the Punjab, no rain has fallen in the country during the week under report. No reports have been received from Burma.

The kharif harvest has been almost completed in the North-Western Provinces and Oudh and the Punjab, and has been finished in some places in Bombay and Rajputana. In the Central Provinces, Central India, Berar and Hyderabad, the crop continues in good condition. Generally the harvest promises to yield a good outturn in all parts of the country. In Madras, Mysore and Coorg the condition of the standing crops is satisfactory.

The rice crop in Bombay, Bengal and Assam promises well. Cotton prospects in Bombay, the Central Provinces and Berar are good

In Bengal and the North-Western Provinces and Oudh, the poppy sowings are doing well. In the Central Provinces cloudy weather and heavy rains have injured the linseed crop which has been replaced by wheat in many parts.

The rabi sowings are now approaching completion in most of the Provinces, and prospects are everywhere satisfactory.

Fever and cholera continue in Bengal and there has been some mortality from the latter disease in Ajmere. Elsewhere the public health continues satisfactory.

Prices show an upward tendency in a few places in the Punjab and have also slightly risen in Coorg. Elsewhere they are generally steady.

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Bombay Agricultural Department.—Our readers may remember that the reports of all Provincial agricultural departments are thrown into eight heads. In the last number we discussed in detail the report of the Assam agricultural department. We mean to do the same in this number of the Bombay report. On the first three heads viz, organization and maintenance of village records, analysis of districts with reference to security from famine, and system of collection of revenue and rental in precarious tracts, there is not much to interest general readers. Under the fourth head, viz, that of measures of protection, there are good many special points of interest. It may be within the memory of our readers that a few bags of pod shell of babul (Accacia arabica) were sent to the Secretary of State for India in London to have the opinion of experts on its value as a dye substance. Since then the reply from the Secretary of State has been received. Mr. T. Wardle thinks that as a dye the substance has little value. It produces only a fawn dye. But it has properties as a mordant, and its value in dyeing arises from its contained amount of tannic acid. This both helps to form a black with iron salts and to brighten and fix some other dyes. Compared with the price of sumac, £ 16 per ton, Mr. Wardle thinks that the pod shells should fetch £ 9. He throws out a suggestion that the tannin should be extracted in India from not only the pods, but from the bark and even the branches. Mr. W. N. Evans, another expert, states that the amount of tannin extractable is more than 25 per cent, which is the amount obtained from balonia.* Mr. Wardle estimated the extractable percentage of tannic acid at 10-26 per cent., equivalent to 15-39 per cent. of tannin, as compared with 18 to 20 per cent. from sumac. Mr. Evans points out the advisability of gathering the pods ripe, to facilitate the separation of the seeds, which make up 60 per cent of the seed pod and contain no tannin. Other experts declare that the material is not rich in tannin. The valuations of the pod shells vary from £ 9 to £ 10 per ton. In a note prepared by Government of India in 1884 the dry legumes (minus seed) were valued at £ 40 per ton, but even at the reduced estimate the extraction of tannin would probably pay. The encouragements given for the extention of babul plantations have not drawn many persons in the field but on the whole Mr. Ozanne takes a very favourable view of them. We reproduce below his remarks. " Though these facts and others are true, I contend that there is ample and useful scope for encouraging the growth of the babhul in good soil, and in special babhul plantations. Besides the possibility of a profitable export of tannin, it is in other respects a tree of great utility, provided it is confined to set areas. I am beginning an experiment at the Bhadgaon Farm which I think will prove its value. This experiment consists in sowing babhul on carefully cultivated and good land, in rows 12 feet apart. Between the rows cotton has been sown. The babhul thus gets the benefit of the bullock-hoeing for the cotton. Next year an early crop will be taken. After that the land will be left to babhul, and will yield a profit in yearly thinnings. It remains to be seen whether it will pay best then to clear away the babhul, or leave it to grow. If left, the land will, when the babhul is high

enough, yield good grass. Such a babhul reserve close to a village in the dry black-soil plains of the Deccan and Southern Maratha Country would give a good profit, and I think that the design of the Resolution is that owners of *occupied land* should thus be induced by suitable remissions of assessment on the land so devoted to babhul to grow the tree. This all tends to show that the proper and profitable use of the tree is secured by confining it to set areas. It has a known capacity for taking up salt from land which shows a tendency to infertility from an excess of salt. In the Don Valley, where reh or salt efflorescence sterilizes land, this growth of babhul was a common practice when land assessments were lower and when land could be thrown up for a term of years with the certainty of its recovery when required."

* * *

In noticing the annual report of Mr Stormont, the able Superintendent of the Bhadgaon Government Farm, the curious but interesting observations of the superintendent on the injurious effects of the shade of babul trees on adjoining crops were reproduced. We now have them confirmed by the testimony of the Director of Agriculture, who remarks that "the sum and substance of my whole study of the subject is that babhul should not be planted nor allowed to grow either as a road-side tree, or on canal banks, or amid cultivation; but that it should be relegated to separate areas. District officers have the power of thus encouraging its growth. Dr. Gibson, whose advice as to the selection of road-side trees has been considered worthy of being accepted as the standing order on the subject, declares that the imperfect shade of babhul is a drawback against its utilization as a road-side tree, but he adds that the ease with which it is raised and its hardiness in growth render it desirable for planting or for being kept up when it springs up naturally, as is often the case, near the other trees on the road line. In the standing orders, Government directs that babhul should never be planted as a road-side tree, except where no other trees will thrive. It affords a very imperfect shade, but the further direction is given that babhul should be tolerated when it springs up spontaneously in soil well suited for its growth, for it is better than nothing, and that it is not intended that babhul should be cut down to make room for other trees. I place on record my conviction that, to use Mr. Stormont's words, in cutting down field babhul the cultivators are carrying out a much-needed agricultural improvement, and I trust that these remarks will lead to a modification of the standing order that babhul should be tolerated when it grows spontaneously on road-sides, and to a stricter reiteration of the order that it should not be planted either on road-sides or canal banks. I have noticed numerous cases where babhul springing up spontaneously is doing great harm to nim and other better trees, and the Collector of Khandesh has wisely assented to my proposal to thin out babhul thus obstructing on the road from the Bhadgaon Farm to the Pachora Station. Babhul springs readily in black soil, especially on loose banks, and if it is not cut out will rapidly increase the injury it now does to cultivation as time goes on. I must here notice that babhul and other trees planted on roads running east and west do very much less harm than when the road runs north and south. Whatever other injury babhul may do, its shade is the chief cause of the harm done. I have not made any exception for road-side spots which do not adjoin valuable cultivation, simply because in such babhul will not grow."

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While reviewing the annual report of Mr. Stormont on the Bhadgaon Farm sometime back, we had occasion to discuss in detail the results of manuring with cowdung and its ashes, and to observe that his remark "the cultivator who applies 30lbs of fresh dung to his land, instead of its ashes, gains thereby Rs 4 worth of grain at the sacrifice of Rs 20 worth of fuel for his domestic hearth" had been unwarranted. Let us see what Mr. Ozanne has to say on the above statement. He says "I had to point out an overstatement last year and have to do so again now. The above conclusion is unwisely based on the first experiment only. If the calculation is made on the average of the latter two, the gain in fuel will be found, even estimated at the rates used by Mr. Stormont, to be Rs. 13, but that in crop nearly Rs. 10 in one year, with a certainty of still greater proportionate gain the next and perhaps the third. The conclusion also neglects the mechanical and other benefits arising from the application of the fresh dung.

* * *

The Nadia'd Farm is a private institution, managed by a committee of practical agriculturists, who are desirous of furthering improvement in agricultural practice. They have spent a large sum in converting an uneven, low-lying, camping ground into a plot suitable for experiment. The Association has sent students for instruction to Saidapet—an example imitated by a considerable number of youths in Gujarat. It has instituted an agricultural show, which is held once in two years. The show of 1884-85 was a great success, and for that to be held next January over Rs. 6,000

are available without any subscription from Government. It has established through the Educational Department an agricultural class at the High School, the students having the fullest opportunities of watching the operations of the farm. The leading spirit is the President, Mr. Behechardas Veharidas, who has done conspicuously important work in the improved cultivation of tobacco and in curing the leaf for the European market. Its income is derived chiefly for an agricultural pamphlet largely circulated throughout Gujarat. An important change in the relations between the Association and Government has lately taken place. The land of the farm (12 acres) has been granted free of assessment, and water-rate, as long as it is used as an experimental farm for the furtherance of agricultural improvement. The Association has established a shop for selling selected seed. It is unqustionable that agricultural seedsmen would, if established all over the country, confer immense benefit. The object of the Committee is to create an appreciation for good seed. This is an instance of private enterprize in agriculture which is entirely wanting on this side of India.

* *

Mr. Ozanne is attempting to introduce steam machinery to thresh and clean wheat and the progress of the project has been detailed in the October number of the Gazette. With reference to clean wheat and enhanced price, Mr. Ozanne remarks. "There is abundant evidence that though the dirtiness of Indian wheat is admittedly the principal reason why it does not secure a market suitable to its merits, it will be no easy matter to secure a fairly enhanced price for clean wheat, owing to the difficulty of securing the co-operation of the traders in wheat, who are wedded to the long-established custom of allowing a refraction varying from 2½ to 5 per cent. on account of dirt. In a special report published by the Agricultural Department, Bengal, some strong facts bearing on this subject have been recorded, which fully bear out the fact that the trade is not yet ready to make any sacrifice or to take any special steps to eliminate or diminish the refraction, which rude methods and the once small importance of the wheat trade established." This fully bears out our remarks on the subject. One large wheat firm in Bombay has undertaken to ship all the clean wheat that Mr. Stormont can send them with the object of securing a special quotation for steam-threshed wheat, and the largest miller in Bombay is ready to take all the soft wheat that can be prepared at a proper price. There is every likelihood of a company being formed in Bombay for importing machinery and getting them out for here.

The lower rate of exchange, the fall in the freight charges and a better harvest of the last season have led to a brisker trade in wheat during the first six months of 1886 compared with the same period of 1885. Till lately, Russia was second to the United States as a wheat-supplier to Great Britain. This position she has lost. The returns of the Customs Department of Great Britain for the first seven months of 1885 and 1886 show a falling off of more than 50 per cent in the imports of Russian wheat. The imports of Indian wheat, on the other hand, show an increase of 6 per cent; in fact, during the first seven months of 1886, India supplied Great Britain with more than twice as much wheat as Russia. There has also been a considerable falling off in the imports from the United States, which tends to show that India has been able to increase her sales of wheat in the English market. There is prospect of a wheat trade with Australia also.

* * *

Trade in Cotton and Wheat.—So far as the returns show, about 7½ lakhs of bales of cotton were received into Bombay from all parts of the Presidency during the six months ending 30th June 1886, or nearly half of the total imports into Bombay from all parts of India. Of the 7½ lakhs about 5 lakhs were from Gujarat, including all Native states, about 140,000 from the Deccan (from Khandesh and Nasik), about ½ lakh from the Karnatik Districts, and about 20,000 from Sind. The total exports from Bombay to all external ports amounted to 9,34,000 bales. As regards wheat, the total quantity received in Bombay from all parts of the Presidency during the six months ending 30th June 1888 amounted, roughly speaking, to 72,000 tons, of which about 50,000 tons were from the Deccan (this includes the wheat from the Nizam's territory booked from the railway stations in the British districts), 13,000 were from Gujarat and about 8,000 from the Kanarese districts. The Deccan wheats are evidently the hard white variety in demand in South Europe, the Gujarat wheats are the irrigated soft red wheats (Vajia), and the Karnatik wheats are the hard red wheats which are pronounced by the Chamber of Commerce as suitable for export. The Sind wheats (red and white soft) are not received in Bombay, but are sent to Europe direct from Karachi. The fact that the 72,000 tons represent about a fifth of the total imports received in Bombay during the same period from all parts of India shows the extent to which this Presidency is contributing to the expansion of the Indian wheat trade.

The opinion of experts on Nadian cured tobacco has not been favourable, but further experiments are going on and Mr Jons has still been kept on. Both Mr Woodrow on the College of Science Farm and Mr Gogte in Ratnagiri have improved their area under arrowroot and the preparation of the starch, as well as the cost. Mr Gogte, has in August offered to supply the amount of arrowroot required by the Commissariate at 4½ annas per lb delivered at each station, i.e. at a rate as cheap as that ruling in the Commissariate contracts, where though some samples are clearly as good as that offered, it is not by any means shown that all are as good as the samples analysed. Mr Gogte makes the condition that he should be guaranteed the supply for five years. This last offer is under the consideration of Government. The resuscitation of indigo as a field crop in Gujarat appears likely. In the 16th and 17th centuries, indigo, partly of local growth and partly brought from Upper India, was one of the chief exports of Gujarat. Towards the close of the 18th century (1777) the cultivation, chiefly for local use, would seem to have been on a very considerable scale in Gujarat. But in the early part of the present century it again fell off, and in 1827 had had almost altogether ceased. Indigo in Gujarat was 1,468 acres, of which 557 were in Ahmadabad, 302 in Kaira and 609 in Broach. There were also 3,717 acres in Khandesh. In other districts of the Presidency, it is not grown. Manilla Hemp has been seen to produce very weak fibres in Bombay. Barilla plant is one of the plants recommended for diminishing salt in land rendered infertile by its excess, and also for the reclamation of salt marsh. The seed was distributed largely, but appears to have done well only on the Nadiad Farm. There it was sown in March in a sandy loam, and irrigated till the rains came. The soil is decidedly saltish and so the water of the well used for irrigation.

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The remarks made by Mr. Woodrow on bone mill and bone are quoted here from the report for general information. "The chief event of the year is the arrival of a number of agricultural machines kindly supplied by the Secretary of State for India, including a Bone Mill, thresher, chaff-cutter and winnower, with a bullock power for driving the machines. In our circumstances the most important machine is the Bone Mill. The one supplied crushes fresh or dried bones into pieces not more than 1 inch diameter when worked by four bullocks at the rate of 1 ton daily. I expect to be able to bring those pieces into a soluble form by fermenting the crushed bones by means of decaying stable litter. The 1-inch pieces of bones are larger than have yet been reduced by fermentation within a reasonable time; but as the bones are, for the most part, fresh, and contain much organic matter and water, I hope to be able to report success. Three tons are at present in the fermenting pits, and I expect to greatly increase the quantity immediately. Bones can be purchased here at present at Rs. 14 per ton, and if the crushing and fermenting can be done for my estimate Rs. 6 per ton, the manure will be very cheap. The subject of bone-crushing is of extreme importance for the agricultural advancement of this country, because, as is well known, bones contain, weight for weight, 17 times as much valuable manure as good cowdung, while the selling price of bones uncrushed in this district is not more than three times the price of cowdung. It is also well known that there is no special deposit of phosphatic mineral available for manure in the Bombay Presidency. Yet Bombay exported to British ports, in 1884, bones for manure to the value of £99,248. If this continues many years, the result will be a serious diminution of the small proportion of phosphates existing in our soils, and consequent exhaustion and sterility. The obvious remedy is to crush the bones and return them as manure to the soil they came from, and I believe it will ultimately be highly profitable for Government to supply the farm with a powerful bone-crushing mill capable of grinding bones to meal and the necessary power to drive it."

* * *

Value of Jambhul (Eugenia Jambolana) in ridding tanks and wells of moss was first brought to notice last year. Experiments have been made in the Kanara and Dharwar Districts. Earthenware vessels were filled with the water of wells and tanks infested with the moss. Into one set, chips of the bark of the jambhul were introduced, with the result that the moss blackened and died in three days. In the other the moss kept its vitality and colour. Further experiments in Kanara corroborate former results but it was found that the moss re-appears after a time (about three months).

* * *

Mr. James Strip of Ahmadabad has given account of some interesting experiments on sheep feeding and breeding carried out by him. These practically were keeping sheep on arable land, feeding them chiefly on babhul pods, in the same way as sheep are fed on roots in England. He reports that he succeeded in bringing sheep up to 70 lbs. dead weight, and found the business a profitable one. He does not anticipate a mutton

famine, pointing out that the extensive jungle and grazing lands of Marwar can breed sheep for the whole Presidency. He advocates the cross between the Gujarat and the Deccan sheep. In the whole Presidency, the percentage of area for which no agricultural statistics are available is 27 on the gross area. Of the net area for which statistics are available, 49 per cent are actually cropped, 13 per cent current fallows, 12 per cent available for cultivation, 15 per cent not so available, and 11 per cent forest. Of the gross area cropped 82 per cent are under food crops and 18 per cent non-food crops; of the food-crop area 12 per cent are under cereals, 9 under pulses and one miscellaneous. Of the non-food area 8 per cent are under cotton, 8 under oil-seeds, and 2 miscellaneous. Of the total area on cereals 32 per cent, are under jowari, 18 per cent bajri, 7 per cent paddy and 9 per cent coarse grains.

* * *

Rail-borne Trade.—In round numbers the figures show an increase in the total trade of 6 million maunds in quantity, but accompanied by a decrease in recorded value amounting to 3½ lakhs rupees. Imports and exports, *i.e.*, trade with external blocks make up 59 per cent. of the total. The remainder 41 per cent, represents the local trade or trade of internal blocks *inter se.* This ratio is practically the same as for the previous year. Of the 10 million maunds of exports, 4 millions are credited to salt against 2½ millions in the previous year. In order of importance the other chief exports were cotton goods, coal, metals, sugar and tobacco, *i. e.* articles mostly from foreign parts shipped to Bombay for the up-country demand. Salt went chiefly to the North-West Provinces and Central Provinces. Rajputana and Central India took twice as much, but the North-West Provinces and Oudh 50 times as large a quantity as in the previous year. The export of tobacco from Gujarat and Kathiawar to Rajputana and Central India declined. Road-borne Trade.—The total road-borne traffic registered amounted to 4½ million maunds compared with 3¾ millions of the previous year. Last year imports made up 79 per cent of the total. This year 83 per cent. This trade is practically the traffic with Native States by the chief trade routes. Much of it is again registered as internal rail-borne traffic between the blocks of the Presidency. Thus the principal post in Sholapur is really the registration post of the imports from the Nizam's territory. It is this which explains the high place taken by Sholapur and Ahmadnagar among internal blocks as regards the amount of export traffic by rail.

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Planting date-trees for fruits.—Dr. Bonavia, Civil Surgeon of Etwa, has made the subject his special study. His idea is that whatever may be the value of these dates in ordinary seasons, in times of scarcity they will prove invaluable as human food. He is of opinion that the plant will succeed in many parts of India. To keep strictly to the varieties, they must be raised from offsets. Extracts are given below from his letter to the collector of Etwa on the subject. "The object of importing offsets at all is because the fruit of the latter will be identical with that of the parent plant, and this is the only way of propagating any particular desired variety. This, however, may perhaps not be of great importance. I have just despatched a number of bottles to the Kew Economic Museum, containing dates in spirits, all from trees in Oudh, raised solely from seeds obtained from the Persian Gulf. They are all very fine dates. This shows that date-trees raised from seed give very fine fruit. I cannot, however, say whether they have in any way varied from the fruit of their original parents. The trees in Lucknow which were raised from offsets were imported from Bushire in the Persian Gulf in 1872-73. They arrived in perfect condition, and were packed loosely either in closed boxes, or sewn up in sacks, without any earth whatever. Last year in Bangalore Mr. Cameron imported a number of date offsets also from the Persian Gulf, and they also arrived in good condition. Both these came to India *via* Bombay. Quite recently the Superintendent of the Saharanpur Botanical Garden imported a number of offsets, also from the Persian Gulf, but these I believe came *via* Karachi. I am informed that they reached Saharanpur in splendid condition. Some of them were kept there, some were sent to Lucknow and others to Jeypore, Ajmere and Oodeypur; none of these offsets had a particle of earth. The steamers from the Persian Gulf are those of the British India Steam Navigation Company. Those being cargo boats, go slowly, probably at half speed, as I have experienced, in order to economize fuel: moreover they stop at the different ports to deliver and receive cargo. Therefore these Persian Gulf steamers would probably take as long from Bushire to Bombay as the Peninsular and Oriental steamers, a mail boat, would take from Malta to Bombay. Therefore, in my opinion, date tree offsets can be as quickly and as safely transmitted from Tunis to India as from Busrah, at the head of the Persian Gulf.

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"There is no necessity whatever for the shoots to weigh 40lb as the Vice-Consul at Susa says; nor is there any need for them to be sent surrounded by earth, or to be sent in Wardian cases. All that is required is that the offset stripped of its outer foliage and leaving only the central shoot, should be of a certain weight, age, and vigor, as before stated.

The packing need be no other than a simple closed box or a sack. In my opinion, it would certainly be unsafe in India to plant offsets on the Tunisian system, viz., that of putting layers of straw at the bottom and half-way up in the holes in which the offsets are planted. Probably in Tunis they have no white-ants and this system, although I see no necessity for it, may not be unsafe there; but in India the straw would assuredly be attacked by white-ants, which afterwards might eat the date stumps also. Even without the attraction of straw, Mr. Cameron at Bangalore found that his offsets were being attacked by white-ants, and he thought it safer to lift them up, and replant them in large pots in the shade, where, when I last heard of them, they were doing well. All that is wanted, in my opinion, is good soil, shade, and ample watering, until they strike, and the best time for their reaching India is either September or October. Offsets from the saline oases of south Algeria, I admit, would be difficult to procure as they would have a long land journey on camels to the coast. But of seeds of the Algerian date-palm there need be no difficulty in procuring, as date seeds live long—at least a year and for all we know perhaps many years. This I know, that date-seeds in winter lie under the soil for 2 or 3 months before germinating, while in the hot wheather they germinate in 2 or 3 weeks. The object of obtaining date-seeds from the saline soils of South Algeria is, I think, of some importance. They might be better suited to experiments in the saline soils of Rajputana, where such soils appear to be very frequent. I found no advantage in sowing date-seeds with the pulp on, on the contrary the sweet date pulp may attract white-ants and other insects. In state of nature, the seed would never be sown with the pulp on, as either birds, animals, or insects would have eaten the sweet pulp long before the seed could have had any chance of germinating. Nevertheless there may perhaps be some small advantage in importing seed in the pulp, as the sower would then be certain that the seed is of a fine kind; moreover natives might see what fine dates are like. The bulk would in that case, however, be increased. There is no disadvantage that I can see, but rather the contrary, in the seeds being mixed, provided they be of the best kinds. Varieties that ripen very early or very late would, I think, be especially desirable for experiments in tracts subject to the south west monsoon of India."

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TRADE OF BRITISH OF INDIA.—During past seven months from April to October, private merchandise was imported to the value of Rs. 33,02,97,814 against Rs. 28,76,98,980 and Rs. 30,40,63,968 during the corresponding seven months of 1885 and 1884 respectively. The increase of Rs. 4,25,98,834 over the value of import in the corresponding seven months of last year was mainly under yarns and textile fabrics, the increase on this head alone being Rs. 4,24,03,314. Private merchandise exported during the same period amounted to Rs. 49,10,67,155 against Rs. 44,34,78,325 and Rs. 46,21,39,255 during the corresponding period of 1885 and 1884. The increase of Rs. 4,53,45,805 over the value of export of the corresponding period of last year was mainly under raw materials and unmanufactural articles, and articles of food and drink, the increase on the first head being Rs. 2,15,81,932 and the second head Rs. 1,65,41,106. The gross amount of import duty collected during this period was Rs. 1,38,56,527 and export duty Rs. 30,43,150 against Rs. 1,27,10,791 and Rs. 35,16,585 respectively during the corresponding period of last year. So far as increase in export and import goes, the trade of India which did not suffer much during general depression last year, has increased considerably.

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PUNJAB IRRIGATION.—The cultivated area of the Punjab is 21 million acres, of which 5¼ million were capable of irrigation as far back as 1880 when the Famine Commissioners drew up their report. From the report of the Punjab irrigation adminstration during the year 1885-86, we learn that the area irrigated during the year was 1,787,567 against 1,614,288 acres in the previous year. There was falling off on the Western Jumna Canal and on the innundation canals. The canals of the Punjab have been classified in the report into 4 circles, viz. Western Jumna canal circle, Bari Doab circle, Sirhind canal circle, and Derajat circle. The canals included in and outside of these circles are the Western Jumna canal, Bari Doab canal, Swat River canal, Sirhind canal, Lower Sohag and Para canal, Upper Suttej Innundation canals, Lower Sutlej and Chenab Inundation canals, Indus Innundation canals, Muzaffargarh Innundation canals, and Shahpur Innundation canals. The report is accompanied by four lithograph maps of the four circles besides one general map of the entire canal system of the Province. The percentage during the year of the net Revenue on the Capital invested is by assessments a profit of Rs. 0·12 and by collection a loss of Rs. 0·82, as compared with a profit of Rs. 1·00 and Rs. 0·70 in the previous year. The Capital invested by Government amounted at the close of the year to Rs. 5,52,99,891, to which must be added Rs. 1,18,67,230 contributed by Native States to the Sirhind Canal. The total money invested was therefore Rs. 6,71,67,121, of

which Rs. 82,63,317 have been expended on a famine relief and insurance work—the Swat River Canal. The Capital expenditure during the year was Rs. 22 70,868. The loss after paying all charges and the interest on the Protective and Productive Works amounted to Rs. 4,96,234, in which is included a credit of Rs. 44,922 on account of adjustments of previous years accounts. If this sum is not taken into account the total loss for the year is Rs. 5,41,156. In the expenditure for the year under review the following items have been included: Rs. 5,06,277 interest charges on Swat River Canal to end of 1884-85 and Rs. 1,041 on account of arrears of interest for 10 years on loss by exchange, now shown as a direct charge against the Capital account of the Sirhind Canal. The total surplus receipts at the close of the year amounted to Rs. 2,00,43,257.

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AGRICULTURAL AND TRADING INDUSTRIES:—Says the M. L. Express—Recently a calculation has been attempted in a German contemporary of the relative numbers of individuals engaged in industrial and agricultural pursuits in some of the more important countries of the world. For this purpose an "industrial pursuit" has been made to include the mining and building trades, and by a person engaged in an agricultural pursuit is meant any one connected with agriculture properly so called, forestry, cattle, rearing stock, hunting, and fishing. The numbers show that Scotland takes the lead in industries, 548 out of every 1,000 individuals being engaged in an industrial pursuit, whilst only 188 are employed in agriculture. The most agricultural country is Italy, with 626 persons out of 1,000, whilst only 228 are occupied in various industries. The following table gives the numbers for the chief countries from which statistics have been obtained:—

	Industry.	Agriculture.
Scotland	548	188
England and wales	545	140
Switzerland	419	459
Germany	363	467
France	319	463
United states	244	473
Italy	228	626
Austria	222	598

The sum of these two numbers gives in each case the number of people out of 1,000 who have to rely upon "business," apart from a profession, for their incomes.

* * *

NEW MACHINERY.—Says the M. L. Express:—Some particulars have been published respecting what is stated to be the largest harvesting machine in the world. Of course it is American, and it is said that it has been used successfully in California during the recent harvest. It is a combined harvester and thresher, reaping or binding the corn according to choice, and threshing, dressing and delivering it into sacks as it travels over the field. This machine, which is worked by steam, is the invention of Mr. Berry, a farmer of Tulare County, California, who has been working at its construction during the last six years. It is 38 ft. wide and about the same in length, and it cuts a swath of 22 ft. Two engines are used in working the machine, the larger of which, of twenty-five horse-power, moves the harvester along and works the header knife if required, while the smaller one of six horse-power drives the threshing machinery. As the sacks are filled, they are sewn up and dropped in the field. The straw is passed on to the furnace to be used as fuel, and the chaff is blown out on to the ground with any surplus straw not required for fuel. The only horses used are those in one team hauling water for the engine, and another following the harvester to pick up the sacks of wheat. The men engaged in the work are the engineer, fireman, steersman, header-tender, sack-sewer, water hauler, and sack-hauler. With these seven men it is said 50 acres can be headed and threshed in one day at an outlay, apart from wear and tear, of about 40 cents per acre.

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WORLD'S SUGAR.—With regard to the world's production of sugar the following particulars from the New York Commercial List may be of interest:—The price at which sugar is now selling all over the world, but particularly in the United States, has led to the impression that the present condition of affairs is abnormal, and so it is, compared with the average value for many years past. Only twice within the past thirty years has the value of raw sugar fallen as low as it has now in the United States, that was in 1861. In Europe the scientific cultivation of beet has increased its saccharine value nearly 50 per cent. The progress that has been made in improving the process of crystallisation is said to be equally startling, new methods of work and the use of improved machinery having caused a complete revolution in sugar-house fabrication. These changes have been brought about by the struggle that has been going on between cane and beet, the latter having been handicapped by the superior inherent qualities of the former, as well as the long start it had in the race for supremacy. Scientific analysis and mechanical ingenuity, however, have been steadily pushing the beet industry step by step, until in 1884 it seemed as though the climax had been reached.

It was said that values had reached point where all profit had been eliminated, and only ruinous loss faced those who continued the manufacture and cultivation of either cane or beet sugar. A pause followed, many fell out of the race, and the next year the production of beet fell off 500,000 tons. But this climax seems only to have stimulated those interested to still further efforts, for the production of Europe is again increasing, and now promises to be 500,000 tons greater than it was last year, and yet at an average range of values that three years ago was considered ruinous. Meanwhile, cane sugar has held the even tenour of its way, and last year Cuba produced, with a single exception, the largest crop ever made from the prolific soil of that island. Within the past ten years the production of sugar in the world has increased nearly thirty per cent., and it is safe to say that for the future, production is likely to increase rather than diminish, and that the commercial world has entered upon an era of comparatively low prices. So far as values are concerned, the markets of the world will hence forward fluctuate upon a plane very near their present range. In other words, sugar will continue cheap, and its production is likely to go on increasing, subject to the contingencies of weather and climatic influences. Sugar has become not only one of the stable articles of commerce, but of industrial enterprise. As sugar cheapens its consumption increases, not so much because people eat more at a lower than a higher price, but that as its value declined it can be utilised for manufacturing and other purposes that its cost before prohibited.

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HARVEST RETURN OF THE MADRAS PRESIDENCY.—The total area under all crops during the year 1885-86 was 22,900,594 acres of which 24 per cent. was devoted to paddy, 17 per cent. to cholum, 10 per cent. to combu, 7 per cent. to ragi, 6 per cent. to cotton, 3 per cent. to castor and lamp-oil seeds, 2 per cent. to gingelly oil-seeds and 1 per cent. to indigo. Sugar-cane occupied only 0·2 per cent. of the total area. Tanjore stands first as regards paddy, Bellary as regards cholum. Coimbatore as regards cumbu, and Salem as regards ragi. In regard to industrial crops, cotton is most grown in Kurnool, indigo in Cuddapah, and sugar-cane in Vizagapatam. Kistna produced the largest quantity of castor and lamp-oil seeds, while the Godavari district produced the major portion of the gingelly-oil seeds.

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TEA.—On the subject of tea Mr. J. E. O'Connor in his Trade Review, makes several important statements:—Each year sees a larger export from India. Last year's export amounted to 68,784,249 lbs, of which as much as 66,640,947 lbs. were sent to England, London, continuing to be almost the sole market for Indian tea. Prices have been depressed, as with all other articles, but things were better than in 1885, and, on the whole, the industry during the year cannot be said to have been unprosperous, in spite of the low level to which prices have fallen. It has been necessary, however, to practise the strictest economy and to relieve the gardens of all but indispensable charges. The assumption that too much tea has been sent to Europe is quite unfounded. Europe may be taken to mean the United Kingdom where tea is consumed, for on the Continent tea is little known except in Russia. In the last ten years the imports of tea have increased by only 14½ per cent, or less than 1½ per cent. annually, an increase which is just about equal to the increase in population, and during the last two years, instead of an increase, there has been a continuous decline in the imports. If low prices stimulated consumption, there should in fact, have been a very much larger demand for tea in England, as it was, the reports of tea brokers state that last year the consumption exceeded the supply. In any case, it is quite impossible to say that, for an article of such universal consumption as tea is in the United Kindom, an average increase of imports of less than 1½ per cent yearly means an over supply to a population which increases at quite the same rate. It may be said that smaller quantities are re-exported to the other countries which draw supplies from England, and that larger stocks remain in England. But this is not the case.

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INTERESTS REPRESENTED IN THE PRESS.—Some idea of the importance of the Lancashire cotton industry may be gathered from the fact that it supports several weekly newspapers which are exclusively devoted to its interests. The *Cotton Factory Times* is the most important of these, and discusses in an intelligent manner, from the workman's point of view, any new improvements made in machinery and their effects on the working classes. In a recent issue, it draws special attention to the scarcity of employment in all the large manufacturing centres. Apparently it is growing more difficult every year for even good workmen to obtain regular work. Mr. Wardle of Leek is trying to set up an organ for the silk-dyer. Similarly every interest in the European Countries is represented in the press. We wish we could say the same thing of India.

1. Annual Report of the Agricultural Department, Bombay, for the year 1885-86 ; From the Director of Bombay.
2. Proceedings of the Agricultural and Horticultural Society of India for November 1886 : From the Secretary.
3. Reports on the Internal Trade of the Punjab for the year 1885-86 : From the Punjab Government.
4. Revenue Report of the Punjab Irrigation Department for the 1885-86 : From the Punjab Government.
5. Memorandum on the Prospects of the Cotton Crop of 1886-87 in the Bombay Presidency : From the Government of India.
6. Memorandum on the Prospects of the Burma Rice Crop for November 1886 : From the Government of India.
7. Report of the cultivation of the Date in India : From the Government of India.
8. Annual Report on the Administration of the Registration Department in Assam for the year 1885-86 : From the Chief Commissioner, Assam.
9. Traffic Returns of the North-Western Provinces and Oudh for the quarter ending 30th June 1886 : From the Director, Department of Agriculture and Commerce, North Western Provinces, and Oudh.
10. Memorandum on the Prospects of the Wheat and Jowari Crops in Berar : From the Government of India.
11. Memorandum on the Prospects of the Linseed Crop in Berar : From the Government of India.
12. Memorandum on the Prospects of the Wheat Crop in the Bombay Presidency ; From the Government of India.
13. Memorandum on the Prospects of the Wheat and Oil-seed Crops of the North-Western Provinces and Oudh for November 1886 : From the Government of India
14. Indian Silk Culture : From the Author.
15. The Game Fowl Monthly : From H. P. clarke, Wooster, Ohio.

Thanks of the Editor are recorded for the above contributions.

THE HINDU PATRIOT AND THE AGRICULTURAL DEPARTMENTS.

Our esteemed contemporary of the Hindu patriot in a leader on the above subject in its issue of the 13th instant recommended the abolition of all agricultural departments both provincial and imperial on the ground of "cutting down superfluous expenditure and practising rigid economy." Our contemporary who is generally well-informed on all subjects does not however seem to be so strongly posted in facts regarding agriculture and agricultural departments. We echo his sentements and say, cut down by all means "superfluous expenditure and practice rigid economy" ; but that the departments of which he recommends the abolition are either expensive or superfluous he has not made out. That they are not a mere luxury as our contemporary seems to intimate, will be amply proved by simply looking at the principal heads into which their work falls. They are (1) Organization and maintenance of village records, (2) analysis of districts with reference to security from famine, (3) system of collection of revenue and rental in precarious tracts, (4) measures of protection including arboriculture, irrigation etc, (5) agricultural experiments including farms, and forecast of principal crops, (6) cattle breeding and veterinary establishment, (7) agricultural and fiscal statistics, and (8) trade and trade statistics. To call the departments which have in their hands the practical working of these manifold duties superfluous and to ask for their abolition or amalgamation with other departments of the State, display astonishing want of mastery over details of administration which we could ill excuse in an organ of such reputed sagacity.

We have been watching our contemporary for sometime and have found him take great pleasure in running down in season and out of season all Agricultural Departments and the Bengal Agricultural Scholars along with them as if they are one and the same thing, and try to justify his position by quoting times without number Sir Ashley Eden's opinions against experiments and model farms, quite unmindful of the fact that neither model farms nor experiments make the departments, nor unmake them. The great misapprehension he labours under, is to identify agricultural departments with model farms and experiments, and from the failure of the latter to infer the failure of the former. If he can rid his mind of this mistaken identity, much of his misapprehension on the subject will be dissipated.

Then again the departments have not yet had a fair trial. To create a department one day, knock it on the head on the second, and to re-uscitate it on the third and to threaten it with destruction on the fourth do not tend to secure its efficiency. Besides ever since their creation they have been crippled in their resources and handicapped in various other ways. Our contemporary remarks "Now, the Agricultural Departments in India do not, as a rule, possess the technical agricultural knowledge for which the Famine Commissioners spoke." Then why don't you try to secure to the departments the required technical knowledge, instead of running them down wholesale and recommending their abolition ?

Mr Charles Elliot, late Secretary to the Famine Commission and now President of the Finance Committee, have, we hear, strongly recommended the retention of the Agricultural Departments. Govern-

ment of India, however, is not bound to abide by the recommendation of the above committee; "the subject should," to repeat the words of our contemporary, "receive the careful and attentive consideration of Government." We do not know yet what the result of such consideration by the Government would be, but we do know that the future of the departments, if kept up, is full of promise. They have, at last some of them have, become the means of increased revenue to the State. We quote at length what we wrote in our November number.—

"The most noticeable feature in the report (Assam Agricultural Department) is the settlement during the year made on cadastral results. The tract settled is one of 228 square miles, comprising nine mouzas in the northern part of Kamrup, which had been surveyed in the season of 1883-84. The regular settlement concluded amounts to Rs. 1,21,775 against Rs. 1,10,527 in the preceding year and a maximum of Rs. 1,14,379 in the ten years preceding. This increase in largely due to cadastral survey carried under the supervision of the provincial agricultural department. That agricultural departments are not mere spending departments, or a luxury either, is thus proved by testimony of facts, the further corroboration of which if wanted could be got from the Agricultural Departments of the Central and other provinces. This increase of land revenue will not fall heavily on the people, because it is mostly due to readjustment of boundaries and more accurate preparation of field books, rentrolls and leases. Increase of land revenue naturally leads to decrease of taxation and the department which tends to alleviate the burden taxation is sure to be welcomed by the people."

"As regards agricultural inquiry," says our contemporary, "we do not surely require an expensive department for the collection of *untrust worthy statistics*." The Italics are ours. For condemning the collection of statistics as "untrust worthy," he ferrets out some passages written by one Mr Wrght in 1880-81 bearing out his remarks. Writing in December 1886, he should have examined later statistics of the North-West agricultural department before using such strong and pointed language. Statistics if not reliable are worse than useless, they are positively misleading and therefore mischievous. If we want statistics of guaranteed accuracy from the agricultural departments, the required agency must be provided. But have they got the required agency? In Bengal, for instance, attempts were made last year to forecast the outturn and area of jute crop, which in the absence of any agency for the purpose, could not be more than mere happy guesses of trained minds. But the defects surely are not inherent in the departments, they are merely incidental and it should be our effort to have these defects remedied.

Regarding the necessity of a separate Agricultural Department, the Famine Commissioners wrote. "The administration of famine relief would therefore be more effectually carried out and controlled if the measures it requires, instead of being started afresh as each occasion arises in the manner which at the moment seems most convenient, were not only conducted on a well-considered and pre-arranged plan, but also were placed definitely and permanently under some special branch of the secretariat, both in the Government of India and in the local Governments. Such an office in each province would have charge of all the records of past famines, and take note of all that is being usefully done or learnt in neighbouring provinces, so that the gathered results of past experience might be collected and made accessible, which has hitherto been hardly possible. Through this office should be brought together the more comprehensive and exact record of the agricultural, vital, and economic condition of the people, to the urgent necessity of which we have already drawn attention. Especially when a famine is thought to be impending would such an office become important, as it would supply the Government with all statistics bearing on this subject, and would be responsible for working out from them the conclusions on which the decision as to future action would mainly rest. When a famine is in progress, all the information relating to relief measures, their extent, their cost, their results, would be collected in it and presented in a uniform and intelligible manner, and through it all orders of the local Government relating to famine administration would be issued. A corresponding branch of the secretariat of the Government of India would occupy a similar position in relation to the Viceroy and his Council, as regards collecting and recording information, advising the Supreme Government, and conveying orders to the local Governments."

If the departments constituted on the lines laid down in the above extract succeed in carrying out this one object, of anticipating famines and administering famine relief on a rational principle, they will have more than amply justified their separate existence. By their knowledge of village statistics as regards rainfall,—area and out, turn of food crops, and other cognate subjects, the departments will be in a position to anticipate and forestall impending scarcities and famines and to give timely warning, which alone will be the means of saving thousands of human lives.

If our contemporary wants the Agricultural Departments to work miracles, we suppose they will plead inability. Barring that, whatever the Pioneer or the Englishman may say to the contrary, the departments of agriculture speaking generally have given hopeful signs of their usefulness which with their development will be rendered still more clear and apparent. We can assure our contem-

porary that contrary to what he has heard, there is a strong party in the council of the Secretary of State for India, who advocate the retention of the departments and that the departments are in all likehood not only to be kept up but materially strengthened.

TOBACCO CULTIVATION IN EUROPE.

The last number (October 1886) of the Journal of the Agricultural Society of London contains an able contribution by Mr. Jenkins, the Secretary of of the Society and Editor of the Journal, on the cultivation of Tobacco in the North West of Europe. The cultivation of Tobacco in India dates from a very ancient time but owing to defective mode of growing, curing, and preparing for the market, Indian tobacco has as yet failed to secure any market outside India. The quantity that we do grow is not even sufficient for home consumption. Annually we have to import about 9 lakhs rupees worth of manufactured tobacco " as cigars and other sorts," and about fifty thousand rupees worth unmanufactured tobacco.

That with improved methods of growth, curing and preparation for the market, our tobacco cultivation is capable of unlimited expansion is beyond doubt. No doubt attempts have been made both by the Government and private parties to adopt improved methods of tobacco cultivation, but these were in most cases desultory and, unless a sustained effort is made under skilled supervision, no permanent improvement can be effected. We know of a private tobacco farm at Pusa (Bengal) and of another in Nadiad (Bombay) and hope their efforts will be crowned with success; but experiments on a larger scale, or, at any rate, under varied conditions of soil and climate with skilled supervision as that of the Regie in France, is absolutely necessary to ensure success and thereby expand its cultivation. Ordinary staple food-crops as rice, wheat, etc, or even ordinary industrial crops as cotton, jute, etc, are cultivated sufficiently well enough. and the agricultural reformers would do better if instead of troubling their heads on the score of improving them, they turn their attention to such crops as tobacco, flax, etc a field in which their special knowledge, training and energy will be more usefully employed. For the use of those who may be willing to know the practice of the French peasant, we give below the extract containing the "Advice given to cultivators on the growth of tobacco in France" and published by the Royal Agricultural Society of Paris (1791).—

"A decree of the National Assembly of the 12th of February, sanctioned by the King, renders free the cultivation of tobacco throughout France. Although this plant is not one of those necessary to the life of man, nor very important on account of its consumption in various countries, yet the number of people in France for whom it has become a necessity is so considerable, that the means of increasing and bringing to perfection its culture should not be neglected. Therefore the Agricultural Society has gladly taken the very first opportunity of enabling all the agriculturists of the kingdom to benefit by this decree, by the showing those who do not already know, how to propagate and prepare the tobacco.

"The details in which we are about to enter have been taken from information received, from several members and correspondents of the Society.

"The tobacco plant like many others, is sown first of all in a nursery or seed-bed, and transplanted when strong enough. The nursery should be a hot-bed in the districts where the spring is cold and simply a strip of garden land in regions where the beginning of that season is mild.

"Cultivators should conduct gardeners on the method of making the seed-bed and on the degree of heat which it should possess when the seed is sown. Fresh horse-dung is generally used; but in default of that, cow-manure is employed, although it is not as good. To plant an "arpent" (about 1½ acre) of land, ¾ of an ounce of tobacco-seed is required, which should have a seed-bed 22 feet by 4. The soil must be from 1½ to 2 feet thick. The manure being well pressed, it is covered with 6 inches of earth composed of garden and leaf mould, or of garden soil only. The bed is surrounded with boards to support it and prop up the frame, if in a country where the latter is necessary.

" Two-year-old seed will germinate as well as that of one year, but an older seed cannot be relied on. In case of doubt, a few seeds can be sown as an experiment in a frame, or under a bell glass, or a seed-bed. The sprouting of a few seeds may be hastened by placing them in a piece of linen, moistened from time to time and kept in a warm place. When the sprouts are from ¼ to ½ an inch long, the seed may be sown, and very soon comes up.

The time for sowing tobacco in France is from the end of February to the end of March. This plant being very sensitive to frost when young, as also when approaching maturity, must be preserved from the frosts of spring, and must also be sown early enough to become ripe before the hoar frosts of autumn. A fine day should be chosen to sow the tobacco seed. The seed being very small, either

sand or earth is sometimes mixed with it to insure its being more equally distributed. As soon as sown, it should be watered with a very fine rose and covered with a very thin layer of finely sifted earth, so as just to cover the seed.

"A necessary precaution is to cover this seed-bed with some light straw, either newly threshed, or taken from the manure of an old seed-bed. The result of this covering is that the earth is not disturbed nor the seed washed away by watering, therefore it comes up more equally than it otherwise would. If sown early in a cold climate, it should be covered at nights either by boards supported underneath, or by bell glasses, by branches, or by long manure. There are also tobacco growers who use frames covered with squares of glass or oiled paper. Finally, in order to force the sprouting of the seed, some people close the bed for three or four days, using a frame and covering the joints with cow-dung; after this they air the bed, water it, and shut less carefully. We do not recommend this method, because those who do not know how to employ it properly scorch the seed and the young plants, or make them come up too quickly and prevent them gaining strength. It is not necessary to cover up the seed-bed if one knows how to take advantage of the heat which it contains. This can also be made greater by adding manure round it, if the atmosphere remains too cold.

"Care should be taken to keep the young plants weeded, and also watered when necessary. The precautions which we indicate for the seed-beds apply equally to ordinary strips of land which are used where special seed-beds are unnecessary. The plants of the seed sown in February can be transplanted in May, but those from seed sown in March must be transplanted later in the year. If transplanted too young or too old, it will be equally troublesome to make them take root. When they have developed five or six leaves, the weather being favourable, they are sure to do well. They should not be planted out until there is no further fear of frost, because they cannot be protected in an open field. In Paris it very rarely freezes after May 10th. The land on which tobacco should be planted requires preparations which we shall now describe.

"Tobacco should be first grown in small quantities on all sorts of land, in order to see which gives the greatest quantity and the best quality. The obstacles which, until now, have been placed in the way of cultivating this crop, have prevented us obtaining enough experience to give advice on this point. But if any one wishes after this year to plant a large quantity of tobacco, we should feel obliged to tell him beforehand that, according to all the information we have received, tobacco succeeds best on a "substantial" soil. By this word we mean a soil composed of sand and vegetable matter, or of light land well mixed with clay. It must be deep and well mellowed. Cleared woodland, broken up grass-land, and newly-reclaimed land are the best for tobacco, as they may be regarded as new land.

"According as the land destined for tobacco-growing is more or less compact, it should be more or less worked. If the plough is used, one furrow should be turned before winter, so that the frost can pulverise the clods; and the land should be worked twice after winter, namely, once at the beginning of spring and once a little while before the transplantation of the tobacco. Certain must land be worked four times, once before winter and three times after, and it must be harrowed after each time. Preparing the land with the spade or the fork is preferable to ploughing, but is more expensive. It is then sufficient to give one digging before winter and one at spring time, unless the ground is very foul, in which case it requires a third stirring.

"Manure must never be put on newly broken-up land, but only on that which is regularly cultivated, and which has produced wheat or some other crop which has exhausted it. As the tobacco-lands are generally strong, the manure of horses, sheep, and poultry, with dried night-soil, are generally preferred. It is needless to tell cultivators in general, that if they use strong land they should also use fresh manure as well as marl, chalk, or lime, to lighten it; and when the land is too light, it should be made stronger by using ripe manure, specially cow-manure, chalk, and clay. These preparations of the land are as necessary for tobacco as for maize and wheat.

"The quantity of manure indispensable for the crop depends upon its kind and condition, as well as upon the nature of the soil. It is sufficient to say that the land for tobacco should be manured the same as for wheat.

"When the work is done by hand, small mounds should be raised, the bases of which should be between 2 and three feet in diameter. In the last working by the plough, large ridges should be raised similar to those made when a vineyard is to be planted. These take the place of the mounds.

"When the land has been thus prepared and the seedlings have reached the proper height and strength, the next step is to plant them. This should be done after rain, as it is necessary to have every facility for taking up the plants with all their roots and rootlets, together with a small portion of earth, and then to place them in soil which will not

dry them up. In the case of dry weather, the seed-bed or nursery must be well watered as well as each plant when pricked out. Care should be taken not to water too much at once, as it is better to water twice.

"Planting out is done in the ordinary way by means of an ordinary planting stick; the plant is then buried up to the first eye, that is to say, up to where the leaves begin to sprout. Then with the aid of the dibble, the earth must be pressed tightly round the roots. When the mound system is adopted, a plant is placed in the middle of each mound; when the land is in ridges and furrows, the plants are placed about 2 feet apart, so that they form a quincunx: the poorer the land the farther the plants must be put apart. Sometimes a late frost kills the young seedlings, in which case they should be replaced by those kept in reserve in the seed-bed.

"The tobacco field should always be kept free from weeds; weeding being done as often as is necessary; it should at least have three weedings, the times depending on the state of the field.

When the plants have attained the height of about 1 or 1½ foot, which they do about six weeks after plantation, they are ridged up like maize and potatoes this operation, can be performed with a hoe, a narrow spade, or any other appropriate implement. When the plants begin to show blossom-buds, these must be picked off with the fingers as well as the growing point, so that there remain only twelve or fourteen leaves. The plant is then reduced to the height of about two feet. Small shoots soon grow out from the axils of the leaves and should be pinched off as soon as they appear, so that the sap may be entirely concentrated in the leaves; this last is the chief object of the cultivation.

"To obtain seed, a few plants in the field are left untouched. Very few must be left if the seed is not for sale, as one good plant yields enough seeds to sow an "arpent" (about 1¼ acre). The most vigorous and the oldest plants of the first plantation should be reserved for seed, and not those which have replaced others. In Holland, all the leaves of the seed plants are picked off as they grow, so that all the sap may rise to the seed. The seed plants are not gathered until the seed-cases become black. They are then cut and hung to the roof of a shed or room until spring. The seed improves in the quality and keeps well in the capsules. As for the plants which have been nipped in order to furnish the true tobacco, the leaves are ready when they begin to lose the vivid green which characterises them, and acquire a slightly yellow colour. They then drop, diffuse their perfume to some distance, and become covered with small spots, while their margins break very easily in the fingers.

"The leaves do not all ripen at the same time, therefore they cannot all be gathered together, but the bottom leaves are gathered first and then gradually the upper ones. For this reason, in some districts, there are three distinct qualities, the best consisting of the top leaves. In the best establishments each quality is kept apart from the other.

"As the leaves are gathered they are placed one on top of the other as neatly as possible, and then carried to the drying shed.

"The leaves are threaded with twine, or thick thread, and suspended on rods, or else they are pierced and threaded on alder or willow poles from 5 to 6 feet long and an inch thick. The leaves are so placed that the ribs of one do not touch those of the other. The poles rest on pieces of wood and are placed under each other in a dry shed or barn, with openings all round, so that wind can dry the leaves, which are also shaken from time to time, especially when it is not windy. The greater the distance between the poles, and the farther apart the leaves, the easier they are dried. The higher or first quality leaves, being thicker and more fleshy than the others, require longer to dry. The leaves are always picked as close as possible to the stem, so as to waste nothing.

"If the weather is cloudy or damp, a fire must be made in the drying shed to prevent the leaves rotting, but in dry weather one must be careful as to the employment of artificial heat.

"Practice teaches best when the leaves are sufficiently dry. If too dry, they lose their perfume; if too damp, they rot. The best way of telling is when a handful of the leaves are pressed in the hand they regain their proper shape without being broken immediately they are released.

"When the leaves are dry enough, the poles are taken down and laid on the ground, the leaves still remaining on them. They are placed one on top of the other in the form of square, an empty space being left in the middle so that the vapour which comes from the leaves may find outlet; they are left in this state for a week or a fortnight, after which they are covered up until they are tied into bundles, which is done by means of large wheel placed in front of the table on which the tobacco is gathered These bundles are placed in matting, hampers, or casks containing 12, 13, 14 or 1500lbs. each.

"The stems remaining after all the leaves are gathered are used to manure the laid by being ploughed or dug in.

These directions given for the cultivation of the tobacco plant in Europe may not be a reliable guide in India but show clearly in which way the reform should be directed. In getting better quality of leaves suited for making cigars, attention should specially be given towards the invention of some good special manure for tobacco. Potash is admitted on all hands to exert beneficial effect on its growth and quality. Discussing on the merits and demerits of various manures used for tobacco in North-West Europe, Mr. Jenkins comes to the following conclusion. He says that the influence of potash is specially physical, not adding to the weight of the crop, nor having any appreciable effect upon the percentage of nicotine which it contains, but giving to the leaves fineness and suppleness; that therefore the best cigars are made when the leaves are gathered before maturity, and when they contain the greatest quantity of potash. The practice of tobacco growers in north Bengal of giving a liberal dressing of ashes on lands set apart for tobacco cultivation seems to conform with the principle of the European method, since ashes contain a large percentage of potash.

The next point to notice is the system of curing the leaves after harvesting. The system pursued by our peasants is very crude indeed but we are very doubtful whether they could do much by their knowledge of superior system of curing. If the quality of the leaves is bad, no curing however perfect, can improve them. Improved curing should be preceded by improved system of cultivation, especially with reference to manuring and classifying the leaves during harvesting. If the Government is serious in its professions of agricultural reform, as no doubt it is, it should depute experts to make full enquires of industrial crops like tobacco, linseed etc, and suggest improvements on the present systems of their cultivation. We know that attempts were once made to introduce cultivation of flax for fibre in the lines suggested by us and we know as well as they ended in securing no practical good. This failure and similar other failures in past were due to nothing else than want of continuity of action on the part of the Government which we have all along regretted and to which, if left unremedied, failures of similar attempts in future will also be due. An Imperial Bureau of agriculture guiding the action of provincial bureaus is a guarantee against such desultory attempts in future which tend more to retard the progress of agricultural reform than otherwise.

NEWS.

Burma.

The report on the prospects of the rice crop for November 1886 is as follows:—"The area under rice is now reported as 113,223 acres over last year's area, or increase of 3·4 per cent. The weather has been seasonable throughout November, and favourable to the crops, except in parts of Tharrawaddy and Amherst, where the rainfall was scanty. The crop is reported as over an average crop in Akyab Pegu, Prome, Thongwa, and Shwegyin, and a full average crop in Amherst, in Hanthawaddy, Tharrawaddy, Henvada, and Bassein it is slightly below a full average crop. Provided no serious injury is caused by late rains or other unforeseen occurrence, the exportable surplus will probably amount to about 1,100,300 tons."

Berar.

The first report on the prospects of wheat crop and the outturn of jowari crop in Berar is as follows:—"Acreage under wheat above the average, which is 807,009 acres. The crops are a foot high, and a generally in excellent condition. So far we have every promise of a good average crop. The outturn of jowari (or great millet), the staple food of the people, is estimated as quite up to, if not above, the average. The first report on the prospects of the linseed is as follows:—"Acreage under linseed below that of last year, which was 621,030 acres, owing to the excessive rainfall at time of sowing. The crop has suffered generally from untimely rainfall and blight. On the whole, not more than a ten or twelve-anna crop is expected."

Bombay.

The following report has been received for December on the prospects of the cotton crop in districts of the Deccan where cotton is sown in June and July;—*Khandesh.*—Received area about 977,000 acres, or 26 per cent. above average and 44 per cent, above last year. Of the total area about two-thirds under indigenous, that is, Varadi and Khandesh cotton, and the remaining one-third under the long-stapled exotic that is Hinganghati and Dharwar-American cotton. The largest area under the exotic variety is in the south-west part of the district through which the railway line passes, and the area under it in the Jamner, Bhusaval, Pachora and Chalisgaon talukas comprises nearly two-thirds of the exotic cotton in the whole district. The talukas with the largest area under indigenous cotton are Erandol, Sindkheda, Dhulia and Sında,

The rainfall in June was well distributed and especially favourable to cotton sowing; and to this is due the large increase in the area under this crop. The abnormally heavy rain, which fell towards the close of June and occasionally in July was injurious, especially in Dhulia, Pimpalner, Sindkheda and Sanda, rotting the crop in some places where it had to be removed and *bajri* substituted for it. But the break towards the close of July saved the bulk of the cotton and was generally beneficial throughout the district. The August rainfall was particularly favourable in Bhusaval and Nandurbar: The long break in September from the 5th to the 29th was injurious to cotton specially in light soils. The rain that fell towards the close of September and early in October was everywhere opportune and revived the crops. The untimely heavy *svati* rain (22nd October to 3rd November) caused more or less injury in Jamner, Chalisgaon, River and Jalgaon. Though the season is not as much above the average as was expected, it is still on the whole a good one and considerably better than that of last year. The average anna-yield as far as it is reported, falls below 12 annas, in Chalisgaon (10 annas), Raver (9) and Jamner (9) only. In the other talukas (except in Erandol and Shirpur for which no details have been received), the yield is above 12 annas. The first picking has been completed in some parts and the second is in progress. Except in Sindkheda there is as yet very little export trade.

Ahmednagar.—Received area about 56,000 acres, that is, about 233 per cent, above last year anp about 51 per cent. above the average: The chief cotton-growing talukas are Shevgaon, Nevasa, Jamkhed and Nagar. The area in Karjat, Shrigonda and Kopargaon is very small, whilst the western talukas of Parner, Akola and Sangamner grow none. Except about 80 acres in Nevasa, the whole area is under indigenous cotton. As in Khandesh the increase over last year is due to favourable early rains. This increase is general but is most marked in Nevasa, Shevgaon and Nagar. The prospect was at first good, but in parts of Shevgaon, the heavy rain that fell in the beginning of September broke the leaves of the plants. The *svati* rain has also done much mischief all over the district. The anna-yield is reported to be 6 annas in Nevasa and 8 annas in Shevgaon and Jamkhed. Cotton-picking is in progress in Nevasa and Jamkhed. The outturn will be larger than last year. *Nasik.*—Area about 20 000 acres, that is, about 35 per cent. less than the average but nearly 8 times above that of last year. The chief cotton-growing talukas are Malegaon, Nandgaon and Baglan. In Kalvan and Chandor there is a small area under cotton; but in the rest of the district it is not grown. Of the total area, about one-fourth is under exotic cotton and that only in Nandgaon. In June the early rain being light, the sowings were retarded and the month's fall was neither so seasonable nor so well distributed as in Khandesh. The July rain was however more favourable in both respects. On the whole the rainfall was more timely than last year, and to this is due the increase in area. There was a heavy fall of rain nearly in September in Nandgaon and Malegaon where the August rain was insufficient. Then followed a long break relieved by light showers early on October, but these were insufficient. As in Ahmednagar the svati rain was injurious. but no serious damage resulted as the anna-yield is reported to be 10 annas in Malegaon and Nandgaon. The outturn will be largar than last year. In Nandgaon there are already small exports in new cotton which is being sent to Malegaon and Bombay.

Sholapur.—Received area about 29,000 acres or more than four times that of last year and 13 per cent. above the average. The area under exotic cotton is reported to be 254 acres, of which almost the whole is in Karmala. Cotton is grown all over the district. The increase due to favourable rains is very great in Malsiras, Pandharpur, Madha and Barsi. The rains began earlier than elsewhere in the Deccan and were seasonable for cotton sowing, especially in Pandharpur where last year cotton was not sown at all owing to want of favourable rain. The September rainfall was excellent and the prospects were up to that time very encouraging. But the svati rain and the rain that fell about the middle of November injured the crop a good deal in most parts of the district, especially in Karmala, Barsi and Pandharpur. The yield is reported to be 8 annas in Sangola and Madha, 6 annas in Sholapur, 4 annas in Malsiras and Barsi and 2 annas in Karmala. As yet there is but little trade in new cotton.

Poona.—Indapur is the only taluka where cotton is grown. Area 10,672 acres against 230 in the last year. The large increase is due to favourable rainfall in June and July. Here also the svati rain was injurious and caused blight. The yield is estimated at 8 annas. *Satara.*—Area about 13,000 acres, that is, nearly up to the average, but slightly below the area of last year. The chief cotton talukas are Tasgaon and Valva. There is also a small area under cotton in Khanapur, Karad and Khatav; but in other parts of the district cotton is not grown. In Tasgaon the crop is reported to

be good, and in Valva fair; in Khanapur injury from svati rain is apprehended. In Karad damage by boll-worm has been reported, brought on by heavy dews.

STATES.

Akalkot.—Area 1,458 acres, slightly less than last year. Here also the *svati* rain was harmful. Yield estimated at 4 annas. *Satara Jagirs.*—Cotton grown only in Aundh (4,462), Jath (6,755) and Daphlapur (1,021) or 11,218 acres in all. Last year the area in these states was only 4,000 acres. Crop middling, yield estimated at 8 annas.

COTTON PROSPECT, DECEMBER.

Early Disticts of the December.

District.	Area, 1886-87	Area, 1885-86.	Average area for last 7 years	Increase or decrease (in 1886-87) per cent. over or below, 1885-86.	Average.
DECCAN.					
A. British Districts.					
Khandesh	977,295	678,348	773,586	+44·05	+26·32
Ahmednagar	56,037	16,785	36,905	+233·85	+51·84
Nasik	19,930	2,409	30,884	+727·31	−35·46
Sholapur	29,306	6,797	25,829	+331·16	+13·46
Poona	10,673	230	6,030	+4540·40	+77·00
Satara	12,921	16,585	12,322	−22·09	+4·46
Total A. ...	1,106,062	721,154	885,556	+53·37	+24·90
B. Native States.					
Akalkot	1,458	1,486	Not recorded.	−1·89	...
Satara Jagirs	11,218	4,053		+176·78	...
Total B. ...	12,676	5,539		+128·87	...

The first report of the Prospects of Bombay Wheat Crop. up to end of November 1886 is as follows :—Estimates generally up to end of November. Season reported very favourable for wheat, though sowings unusually late, hence figures incomplete; area if anything larger than average in all parts, but not fully reported; hence detailed comparison not made. Latest intelligence: cyclonic abnormal rain in Deccan and parts of Karnatak about 10th December, where very heavy, must have done harm by flooding as in Ahmednagar, still seedlings too immature to be injured by rust, usually induced by December rain. No actual damage reported.

North Western Provinces

The report on the Wheat and Oil-seed Crops for November 1886 is as follows;—Rains continued late in October, but with intervals sufficiently long for ploughing and dressing of the land. Germinating excellent, except in places where it rained immediately after sowing. On the whole, prospects up to 30th November very fair. Area about 4 per cent. in excess of last year.

Internal Trade of the Punjab, 1885-86.— The increase in the total rail-borne trade has again been most marked, and furnishes sufficient froof of the general progress and prosperity of the Province. From a comparison of the figures for past years it will be seen that while the imports have steadily risen, the exports have during that period much more than doubled both in weight and value. During the past year imports have increased by 23 per cent. in weight and 9 per cent.

in value, and exports have increased by 19 per cent. in weight 15 per cent. in value. The Principal causes of this development are, no doubt, the extension of the Railway system and the lowering of the rates of freight charged by the various Railway Companies. It is also certain, and stated in the Report, that Indian trade has received a stimulus from the appreciation of gold and the consequent fall in the prices of food-grains. European and American cultivators cannot afford to sell at prices which still remunerate the Indian cultivator, now that communication with the sea has been cheapened and facilitated. The large increase within the last two or three years of the earnings of the Indus Valley State Railway is noticed in connection with the improvement of the Karachi Harbour; and it is clear this improvement has had a considerable effect in attracting traffic to that line and developing the trade of the Punjab. The most remarkable increase amongst exports have been under the heads of cotton and silk, piece-goods, rice, sugar, railway plant and rolling stock, while export of the wheat have increased by over 50 per cent., having been trebled within the last three years. Exports of rape and mustard seed have fallen off by one-third, but are still six times a large as they were in 1884-84. Fluctuations under this head are very great and and the trade appears to be in an unsettled state.

From the statement of percentages of trade with the various foreign blocks it appears that Karachi still keeps its place as the chief mart for both imports and exports; but the precentages under both heads are less than they were in the preceeding year, a good deal of the increased trade having found its way to other blocks. This block still accounts for 29 per cent. of the total imports and 36 per cent. of the total exports. Bombay Port shows the most remarkable increase, the precentage of total imports having risen from 9 to 13 per cent. The percentages of the blocks Howrah and North-West Provinces and Oudh remain much the same as in the previous year. The value of the exports to Bombay Port has increased from 59 lakhs of rupees in 1884-85 to 101 lakhs in the year under review, the increase being most remarkable under the heads of wheat and rape and mustard seed. The increase in the export of rape and mustard is accompanied by a decrease in the export of these to Karachi and Sindh, and this result points to a different route being now taken by the trade in oil-seeds. The increase in exports to Bombay is no doubt due to the connection of the districts in which oil-seeds are principally grown with the Bombay and Rajputana Railway system. There has been a remarkable increase in the amount of gram exported to Howrah, and the cause of this is not very clear. The import of coal from the North-West Provinces and Oudh block has been more than doubled, and there has been a corresponding decrease in the amount obtained from Karachi. There were also large increases of imports from the North-Western Provinces under heads of rice and sugar. The imports under the latter head are accompanied and in part explained by a large increase in the export of sugar to Sindh. The decrease in the import of coal from Karachi has already been noticed. The total weight has fallen from 271,000 to 2000 maunds, the Punjab now obtaining its supply from the North-West Provinces. Under the head of exports to this block it is noticed that the weight of wheat has risen from 64 to 100 lakhs of maunds, while the export of rape and mustard seed has fallen from 31 to 15 lakhs. The export of rape and mustard seed to Sindh has fallen from 257 to 51 thousands of maunds, while that of sugar has risen from 102 to 215 thousands.

Turning next to the river-borne trade, the figures of which are derived from the registration by the Deputy Conservator of Sukkur of the boat traffic on the Indus, it is observed that there has been an increase both in exports and imports, the total number of boats engaged in the traffic having increased from 1,624 to 1,927. There has been a very large increase in the export of wheat by boat, 50 per cent of the whole value of the trade being in this grain. The export of cotton was nearly double that in either of the preceding years, and contributes 25 per cent. of the whole value of the trade. The value of foreign trade with countries external to British India has varied but little during the past three years. The great increase in the amount of coal imported from the North-West Provinces and the corresponding decrease in the imports from Karachi and Sindh have been already noticed. From the figurs of the last four years it is evident that the sudden diversion in 1884-85 to the Indus Valley State Railway was quite exceptional. The weight imported from Karachi and Sindh in 1885-86 is almost exactly the same as in 1883-84—nearly 29,000 maunds. As already noticed, the weight of wheat exported from the Province has increased from five million maunds in 1883-84 to almost fifteen million, in 1885-86. The Financial Commissioner is at a loss to understand whence all the surplus wheat which is now exported comes from, as the increase in the area under this crop in the Punjab has been very gradual. The weight of rape and mustard seed fell from 44 lakhs of maunds in 1884-85 to 29 lakhs in 1885-86. The general

decrease is attributed to the low prices prevailing in England, and it is said that for the present the export of oil-seeds from the Punjab to Europe does not pay. The Financial Commissioner thinks that there must be a large stock of oil-seeds stored with cultivators and merchants, and that the remedy for the stagnation of the trade would seem to lie in the extraction of oil on the spot and the export of this commodity. The diversion of a large portion of this trade in oil-seeds from Karachi to Bombay Port has already been remarked on.

The quantity of tea exported from China and Japan to Great Britain from the commencement of the season to the 26th of October was 119.749,274lbs., as compared with 128,113 895 lbs., exported in the corresponding period of last year. The exports to the United States and Canada during the same period was 64,233,193 lbs., as compared with 58,387,482 lbs.

Traffic Returns of the North-Western Provinces and Oudh, for the quarter ending 30th June, 1886.—The total external traffic of the United provinces by rail amounted to nearly 143 lakhs of maunds, of which the principal commodities are cotton, wheat, oil-seeds, sugar, ghi, cotton goods, metals, salt, and grains besides wheat. Cotton—shows an increase of 70 per cent. This is due to the crops of 1884, which figured in 1885, having been very poor. Wheat shows an increase of about 7 per cent. This is due to large bargains having been entered into in January and the beginning of February, when the prospects of the 1886 crop were very good The exports of gráins other than wheat remained at about the same figure; the imports, on the other hand, were nearly doubled. The increase is mainly due to the gram which was imported in large quantities from the Panjab into the Meerut Division, where the crop had been poor. The whole of the increase under oilseeds is accounted for by larger export of linseed to Bombay and Bengal. There was some increase under rape and castor seeds too, but it was more than counter-balanced by a falling off in the export of poppy seed, the crop of which, taking the entire province, was less than 75 per cent. of the normal outturn. The total exports of sugar remained at almost the same figure. When however examined in detail the Meerut block shows the falling off of one lakh of maunds, while Rohilkhand shows a corresponding increase. This is accounted for by the extension of the Oudh and Rohilkhand Railway line to Saharanpur, which now carries much of the sugar which formerly started by road and took the rail at station in the Meerut Division. Increase in ghi is due to better season. It occurred entirely in the exports from the Agra Division, which supplies over 18 per cent. of the total quantity of ghi sent out of the provinces. The imports of cotton-goods increased by 69,275 maunds, and the increase was shared by the ports of Calcutta and Bombay in the proportion of 2 to 1. Salt shows an increase of over 1½ lakhs of maunds, due to increased imports of sea salt from the Bombay Presidency and of Cheshire salt from Calcutta. The receipt of Sambhar salt fell off by over 2 lakhs of maunds. The total canal borne traffic of the provinces amounted to 7 lakhs of maunds. On the Ganges Canal it consisted mainly of timber, bamboos, stone, lime, and kankar from one warf to another in the Meerut Division. On the Agra Canal the traffic consisted in exchange of grains, sugar, and timber from the Panjab for stone and lime from Agra. From a commercial point of view the traffic on these canals is of very slight importance, and its registration has accordingly been discontinued from 1st August, 1886. River-borne trade.—The traffic which crossed the frontier by the Ganges and Gogra amounted to 4 and 16 lakhs of maunds respectively. The exports consisted chiefly of grains, oilseeds, sugar, stone, and lime. The imports consisted of rice, salt, and tobacco.

River-Borne Trade of Assam during the year ending 31st March 1886.—*Imports.*—The figures for Coal and Coke show for the first time a considerable export of coal, nearly a lakh of maunds, from, the Brahmaputra Valley. Imports to that valley have fallen off in value by nearly two lakhs of rupees. The Makum coal-mines now supply nearly all the coal required by the increasing steamer and railway traffic of the province, and most of the coke used in tea manufacture. The coal-imported comes all from Calcutta, and is probably carried by steamers for their own consumption. The Surma Valley has no coal-mines that are worked, and the value of the coal imported was double that of the previous year. The larger consumption is probably due to increase in the number of tea factories using steam power. Imports of cotton twist and have fallen considerably. The figures for 1884-85 were abnormal. Last year's figures were still above the average in the Brahmaputra, and below in the Surma Valley. The quantity of Indian twist and yarn increased, compared with that of European. The continuous increase of cotton piece-goods of the last few years is well maintained in the Brahmaputra Valley. The figures for the Surma Valley show a decrease in the import of European, and an increase in that of Indian goods. From Sylhet it has been reported that " the local weaving industry

is gradually being extinguished by European manufactures of by Indian imitations. There is a marked increase in Gram and other Pulses in both valleys, amounting in all too 88 per cent. Imports of husked rice increased by a lakh of rupees in value in the Brahmaputra Valley, and fell off slightly in the Surma Valley. Exports rose largely in the former and slightly in the latter. The quantity imported into the Brahmaputra Valley was 460,211 maunds, as against 379,677 in 1884-85 and 482,677 in 1882-83, the greatest importing year of the last six years. In the Surma Valley the imports amounted to 4,137 maunds, against 4,635 in the previous year. There is a large increase in the imports of brass and copper in the Brahmaputra Valley, and a continued decrease in the Surma Valley. The imports of iron which had fallen off in the previous year, rose again in the year under report. The value of the imports, of kerosin oil fell off nearly three lakhs of rupees, probably owing to the large importations made in 1884-85, as the consumption is certainly not diminishing. The value of the imports of salt to the Surma Valley rose considerably. The average price was much the same in both years, and it is difficult to explain these fluctuations in the import of an article the demand for which must have remained fairly constant. The increase noticed in the import of drained and undrained sugar in last year's report continues. The decrease in the value of the undrained sugar imported into the Surma Valley is due to a fall in price. There was a decrease in the total value of tobacco imported ; the increase of nearly a lakh in the Brahmaputra Valley not making up the decrease of over two lakhs in the other valley. The decrease is partly due to a fall in prices.

Exports.—Tea is by far the most important staple of export, and contributes Rs. 3,02,38,450, nearly three-fourths of the total export trade of the province, Rs. 4,31,72,169. The following table gives details of the quantities exported during the last six years :—

	Tea exports from Brahmaputra Valley. Maunds.	Tea exports from Surma Valley. Maunds.
1880-81	303,609	167,836
1881-82	288,754	183,886
1882-83	348,478	209,653
1883-84	337,717	196,954
1884-85	365,443	189,171
1885-86	428.021	176.748

The figures for the Assam Valley is much the highest reached yet, while the export from the Surma Valley are smaller than it has been since 1880-81. The increase in the import of unhusked rice into the Brahmaputra Valley was accompanied, as might be expected, by a decrease in the export of paddy. The value was only Rs. 79,330, and the quantity 47,018 maunds, against Rs. 3,03,191 and 160 557 maunds in 1884-85. On the other hand, the exports from the Surma Valley rose from 1,918,115 to 2,646,953 maunds. The figures for Mustard for the Brahmaputra Valley show a slight falling off. In the Surma Valley the decrease is most marked. This is probably connected with the larger export of paddy, as the cultivation of mustard is chiefly resorted to in the Surma Valley to make up for a deficient rice crop. In both valleys the mustard crop is reported to have been below the average, and to have suffered for want of moisture. The area reported under mustard in 1884-85 in the Assam Valley was 103,353 acres, as compared with 117,722 acres in 1883-84, and 84,752 acres in 1882-83. Calcutta took two-thirds of the mustard produced in the Assam Valley, and the Chittagong block about the same proportion of that from the Surma Valley.

Organges are exported by boat from Sylhet, chiefly to Calcutta. The crop is reported not to have been a good one. The quantity, taking 430 to weigh a maund, amounted to 85,739 maunds, against 1,20,861 in 1884-85, a decrease of over 35,000 maunds. The total recorded value is slightly in excess of that of 1884-85 ; so that the prices must have risen considerably. In the last quarter of the year prices were nearly double the average price of the third quarter. The business seems to be a profitable one. The Deputy-Commissioner Sylhet, makes the following remarks :—" Dealers in oranges seem to make more profit than was supposed. The usual price at the orange bazars at points on streams near the groves where oranges are shipped for export was Rs. 12 per 3,000 oranges, which was supposed to be a Khasia 'hundred' (the Khasias sell oranges by the 'hunderd' so called). But enquiry shows that 3,600 oranges make up a Khasia 'hundred'. The hill people calculate thus—

6 oranges	=1 ghayi.
20 ghayis (or 120 fruits)	=1 sala or hala.
30 hala (or 3,600 ")	= Khasia hundred.

"Now, at the garden Rs. 12 is the price of one 'hundred' or 3,600 fruits, and the buyers then, as they retail at 3,000 per Rs. 12 to the shippers, gain the price of 600 oranges on every 3,000 they sell.

The imports Potatoe to both valleys have risen considerably; but the most important traffic is the export of potatoes from the Khasi Hills This is reported to be yearly increasing, and the figures bear out the statement; as the quantity has increased from 103,439 to 110,154 maunds, although the value has fallen. The quality is often poor; efforts are being made to introduce better kinds of potatoes. The exports go by boat chiefly to Calcutta. Lime is an import of the Brahmaputra, and an export of the Surma Valley. In both valleys the figures show an increase. The comparatively small export in 1884-85 was due to deficient rainfall, and the consequent want of water carriage. The export has increased by about 6 lakhs of maunds; although prices fell slightly towards the end of the season. The greater part of the lime exported goes by boat to Calcutta. The total of both imports and exports of timber shows an increase. Imports are chiefly to the Surma Valley; about half being by steamer from Calcutta, and the remainder by boat from Chittagong. Planks for tea-boxes make up a large share of the imports. Exports from the Brahmaputra Valley continue to increase, although the trade in Sal timber is reported to have declined. The outturn of other kinds of timber from Government forests more than makes up for the deficiency. The export of raw Jute has again risen in the Assam Valley above the figures of 1883-84. Very little information is given about it in the reports. There is little information given about raw Cotton in the reports. As it is grown chiefly in the hill districts, the area under cultivation is not readily ascertainable. The estimated area was 42,131 acres, against 38,815 in the previous year. The figures given above show a great increase in the value of the exports. The quantity exported was 39,920 maunds, the highest figure recorded in the five years previous being 26,277 maunds, in 1884-85. A large quantity of the cotton grown in the Garo Hills is shipped from places in Bengal below Dhubri, and thus escapes registration in Assam.

INTRODUCTION OF IMPROVED MACHINES, IMPLEMENTS AND TOOLS, INTO INDIA.

It is necessary to bear in mind that the Indian ryot can obtain the services of *eight field-labourers* for the same sum that an English farmer pays for *one labuorer*; and, that even allowing that one English field-labourer can do the work of four field coolies, our labour is still *fifty per cent less costly than English field-labour*.

As manual-labour becomes more costly in this country, so will the use of labour-saving machines become more general. In the northern counties of England, southern counties of Scotland, and over the northern States of America, field-labourers are paid from three shillings to five shillings per day, and, as a consequence, in these districts, all sorts of labour-saving machines and implements are in regular use. Whereas in the southern counties of England, northern counties of Scotland, and over nearly the whole of Ireland where field-labourers can be obtained at from one shilling to one shilling and six pence per day, few of our modern machines and implements are known. In these districts, more especially in the south of Ireland, there are hundreds of farmers who still use the flail in threshing; and the wind for separating the chaff from the grain.

In very few districts in this Presidency, have the ryots had any opportunity of determining for themselves, the practical value of European Agricultural machines. They must not only see them actually working, but should be able at all times to ascertain from observation *the nature of the results obtained*. It is only when employed in regular farm-work, that the qualities of a machine or implement can be determined. Trials made under extraordinary circumstances are misleading. I can imagine no better opportunity for judging of the suitability of a machine or implement for one's requirement, than when in regular use in the hands of properly-trained men, on a well-managed farm. To test a machine under circumstances, it will never be called upon to meet; or under the management of people who neither understand its construction nor its uses, is certainly the most effectual way of preventing its introduction.

I have no hopes of seeing large and costly machines introduced through the agency of Co-operative Societies amongst the ryots; such arrangements have not generally been successful at home. Many agricultural operations are dependent on the weather, and it would usually happen that all the members of such an association would require the implement or machine at one time. Besides, the expense of transporting such a machine as the Threshing-machine from place to place, would be very costly in this country, as trained cattle and labourer whould have to accompany it.

We have as yet no Threshing-machine that will effectually thresh all kinds of Indian crops. Even if these difficulties were overcome, it is

very doubtful whether labourers using well-constructed flails would not more cheaply and effectually thresh out the grain. I am personally acquainted with several districts in Ireland where the flail successfully competes with the travelling Threshing-machine. If we can do our threshing with manual labour as satisfactorily as would be done by the Threshing-machine, why should we sink one or two thousand Rupees of our capital in purchasing one? I believe that a modification of the Threshing-machine, something similar to that in use in Scotland about thirty years ago, which could be made by any village carpenter at a comparatively trifling cost, might be introduced into some districts with advantage; it would familiarize the ryots to the new process of threshing and prepare the way for more complete machines, should an increase in the value of manual-labour render this necessary. So also the old winnowing machine. Blower might be introduced here, its construction is very simple, and it would not cost one-third of the sum asked for the modern Winnowing-machines. Indeed it appears to me that the machines used in England and Scotland thirty or forty years ago, are better adapted for introduction into India, than those of the present day; at that time, we had in England no extensive Agricultural Implement Manufacturers scattered over the country, we had to trust to the village carpenter and smith for the manufacture and repair of our implements and machines. Though the machines then manufactured were rough and rude, in comparison with our modern machines, they were nevertheless simple in construction, strong, cheaply made, and readily repaired. Wood and wrought iron were then chiefly used, and iron castings seldom employed. The large use of iron castings in the construction of English-machines, has prevented their more general use in this country. When an accident occurs to a casting, *The machine is frequently thrown aside as useless*; even if the cost of obtaining a new casting from the probably distant foundery, does not exceed the value of the machine, still such delay, trouble, and inconvenience is experienced, that few care to submit themselves to the annoyance a second time. From information which frequently comes to me in connection with my official duties, I believe there is a very large amount of English agricultural machinery in this country, which have been thrown aside as useless, for the reason I have already given.

I do not think that it is altogether from a lack of enterprise amongst Ryots that English-machines have not become more common near our large towns, where the ryots more frequently see them. I fear to no inconsiderable extent the unpopularity of our machines amongst the native cultivators, is due to the many lamentable failures, and their ghosts in the shape of broken machines, which are frequently met at the auction rooms in our large towns.

I believe much good may be done by introducing amongst the ryots good specimens of our smaller implements and tools, such as grubbers, drill-cultivators, rollers, harrows, chaff-cutters, barrows, shovels, picks, mattocks, axes, hedge knives, sheep shears, sickles, rakes, manure forks, pitch forks, etc., all these are now in regular use at the Government Farm at Madras, in the hands of ordinary field-coolies. A great many of these tools were made on the Farm by ordinary carpenters and smiths, it is in this direction that I hope we may achieve success; at the same time I cannot help expressing the opinion, that, as a rule, *we greatly under-value native implements and tools*; there is a charming simplicity about them, a simplicity almost approaching to that shown by nature in her works. Take for example, the Pioottah, Mumottie, the Plough, and the Drill, they are frequently made of very inferior materials, and are carelessly put together; still, taking into consideration their small cost, and their suitability to the present circumstances of the ryot, I feel sure we have nothing that will successfully compete with them. However, as we expect that the ryot will partly from choice, and partly from necessity, ultimately adopt a better system of culture, a demand for maize, cotton, oil-seed, etc., for export, rendering dry land cultivation more profitable—so we believe will a demand for better tools and implements be generated. In the meantime, it appears advisable to adhere as closely as we can to models of native tools which have been found most useful in this country. By gradually adapting these tools to the necessities of an improving agriculture, we may hope, ultimately to introduce many valuable European appliances, which are now, not only not appreciated, but are actually considered hurtful.—*Journal of the Agricultural Student's Association.*

SUCCULENT FOOD.

By sir John B. Lawes, Bart., L. L. D., F. R. S.

Professor Wallace, in his lecture on cattle feeding, delivered before the Newcastle Farmer's club, spoke of the great importance of succulent food. such being the natural food of cattle; and he pointed out that one of the strongest arguments in favour of silage was that it furnished a succulent food, as a substitute for roots when that crop could not be profitably grown. He also remarked that by soaking dry food in hot water much of the qualities of succulent food could be imparted to it.

In making these observations, Professor Wallace expressed opinions which are generally held by all practical farmers. The question I am about to ask is, whether we have quite such clear evidence in regard to the great superiority of succulent over dry food of the same quality? It will be said at once, in answer to the above question, that you have only to turn an animal in to a good fattening pasture, and to feed another with the hay taken from the same pasture, to prove the superiority of the former. I am quite prepared to grant that the hay would be inferior in its feeding properties to the grass, but the hay would be also very inferior in its *food* properties to the grass, and to carry out the experiment upon equal terms the grass must be cut day by day throughout the season, and so made into hay.

We have analysed the grass as it is cropped by an ox, and we find that it contains much more digestable substances than hay. Again, it will be said:—Look at roots; what excellent food they are. Quite true but roots contain very little indigestible matter and if dried and ground into meal they would still be an excellent food. Whether they would possess equal feeding properties to the succulent roots is the point upon which I am seeking information. One of the largest, and also the most important food ingredients in roots is sugar, and sugar is perfectly digestible in its dry state.

It is by no means clear to us that silage grass will produce more meat than the same grass made into hay; and we are preparing to carry out some experiments this winter to ascertain the ralative feeding properties of these two substances.

The German experiments upon cooked or uncooked foods do not show any clear evidence in favour of the former; and although we hear from time to time of steaming, and other modes of converting dry foods into succulent food, still, the process has never become popular amongst practical farmers. A short time ago we published some experiments where oxen were fed with oats and straw as it grew in the field, cut into chaff, and given with a small quantity of cotton-cake. Their rate of increase was 1 lb. to every 9 lb. of dry food consumed; this is equal to our results obtained when oxen were fed upon swedes, clover, hay and cake.

In the production of milk, and more especially when quantity rather than quality was the object to be attained, I should certainly think that succulent food would have an advantage over dry food. At the same time I should very much like to see a careful experiment tried with the two foods, and the result measured by the amount of butter-fat produced. Pigs fed on dry food stirred up in cold water can produce a greater amount of increase upon a given weight of food than can be obtained by oxen or sheep upon succulent food; and it is known that oil, starch, sugar, and digestible cellulose are rapidly digested by animals when used in a dry state.

In making these remarks I do not wish it to be thought that my opinion is adverse to succulent food. I merely wish to draw attention to the subject, which is at the present time of some importance, on account of the arguments used in favour of ensilage. All the evidence up to the time points to a considerable loss of food materials during fermentation; and at the same time there is no proof that food is formed in the silo from substances which are not food. The ensilage experiments carried out at Bristol by the Bath and West of England Agricultural Society have established the fact that there is less loss of food materials in well-made hay than in either sour or sweet silage. The food ingredients in the silage, although less in quantity, may still possess greater feeding properties on account of being in a succulent condition; and it is for this reason that I have called attention to the value of succulence in food.—*Agricultural Gazette (London).*

A PLOUGHBOY.

Much has been said about farmers and labourers. I should like to make one or two remarks as to how the poor used to get on years back. I had a dear old father and mother, born in 1802, and

I have often heard them talk about barley bread and hard times in the time of war. I haven't long read the Agricultural Gazette during the present times, but I see sometimes what reminds me of the past. The poor now cannot think how the poor used to live years ago on 8s. or 9s. per week. But in my time that was my father's wages, and nine children were born in eighteen years and six months, and all have lived to be married, and doing very well. So I think we ought to know something about the old times. Now let us see how they did live. Well, I never knew my father's table without meat on it one day [in the week], although I was No. 7 in the midst of the hard struggle. No! but there was something I do remember:—All that was able had to help, and, thank God! I had to help, for it taught me how to help them and myself too, while father made nine shillings and mother made lace, and every child, as soon as able, learned to plait at the school—read part of the day, and plait part of the day. No running out of school for two or three hours in a day. Neither was the evening spent in the public-house by father. He was in his garden or putting his pigs straight, for he would always have one or two—one killed to pay rent and one to eat in the house. Firing cost but little, as we boys used to go in the woods. The "statesmen" would allow the poor the old wood, and there was the right of the common as well to cut gorse or heath which grew on them. We lived in one house many years, £4 10s. rent, with one rood of garden to supply vegetables, so that we did not want; and with all their trouble and trial they had good health until they were near eighty years old, and mother eighty-two; so if hard work kills any one it is sometime at it. But I hope they are both now at rest.

Now a word on myself of my own life. As I have said, I was number seven, and never had a day's school. I went to work at eight years old for a shilling a week, as there always was something to do for boys, such as bird-scaring, cow-keeping, or sheep-keeping, driving ploughs, and learning how to cultivate the land properly, and do labour in a proper form. But that we cannot get done now. If we did not do our work properly, there was the old-fashioned way with whip-cord, which would soon learn us the way to do our work properly, and a very proper way, too. I do not regret it, although I had a taste of it. Now, what is the difference? Why, the boys must go to school certain till they are fourteen years old; if they do not pass certain standards, and they will take good care not to do that too soon, for fear they should have to go to work. I think a more disgraceful law never passed. By all means give every child a good plain education, according to their requirements, but not keep them to school to learn each other all the blackguard tricks, swearing more than men knew how to do in the olden times. Why, they think about getting married before they leave school.

How is it possible for carters to bring a boy up after he is 14 to plough and look after horses? Can he get them up in the morning? Do they mind what he says to them? Does he dare to correct them with a whip? To all this I distinctly say no. If he laid hands on the boy his friends would abuse him and drag him before the bench; and the boy knows that and tells him to do it himself, and very often a very unpleasant word or two with it. And I don't think they will be all able to get a black cloth coat on, and a pen behind the ear.

Now there is not a place, or any part of work, but I can turn my hand to on the farm, and that is not all. As I have said, I began at one shilling a week. I can drive plough, hold plough, sow, reap, mow; and I have been gardener, coachman, grocer, publican, toll-collector dairyman, cow-keeper, and now am in a farm of 250 acres on my own account, and, with all the bad times, I can get a good living. Why is it? Because I know how to do it, and, thank God, I have not work now, these poor boys are sent to school, whereas they ought to be learning how to get a living. Honesty, industry, pushing out in the world with both eyes open is the way to live, not to get behind a black pipe and a pint pot; the living don't often come there. Now I think I have done my part of work, and I am thankful to say I can do without it, although I have brought up a good family all doing very well, and without any of the old fashion windfalls of a few hundreds as some have, and that often kills them.

[The above graphic story is taken from the London Agricultural Gazette—Ed. I. A. G.]

CROP AND WEATHER REPORTS.

For the week ending 7th December 1886.

General Remarks.—Except in Madras and in Sind, where there were light showers, the week under report has been rainless.

In Bombay, the North-Western Provinces and Oudh, the Punjab, the Central Provinces and Rajputana, kharif operations have been practically completed and threshing has commenced in places. In Berar, Hyderabad and Central India the harvest is still in progress and promises well. In Madras, Mysore and Coorg the standing crops continue in good condition and prospects are favourable.

Rice is being reaped in Bombay, the North-Western Provinces and Oudh, the Central Provinces, Bengal, Assam and Burma. The crop is reported good and in Bengal the aman harvest is expected to yield an excellent outturn.

Cotton-picking in Berar and coffee-picking in Coorg continue.

Poppy in Bengal and the North Western Provinces and Oudh is thriving.

Rabi sowings have been completed in most Provinces, and the crops, which are coming up well, promise favourable everywhere.

Fever and cholera are still very prevalent in Bengal, but elsewhere the public health is satisfactory.

Prices continue to rise in five districts in the Punjab but are generally stationary elsewhere. Rice in Bengal is considerably cheaper than last year.

For the week ending 15th December 1886.

General Remarks.—The rainfall of the past week has been confined principally to Madras, Mysore, Bombay, Bengal, the North-Western Provinces and Oudh, the Central Provinces and Central India, where there were some heavy showers in places.

The kharif crop which has been harvested in most Provinces is now being threshed. In Berar, Hyderabad, and in parts of Bombay and the Central Provinces, where the harvest is still in progress, prospects are favourable in Madras, Mysore and Coorg. The condition of the standing crops is satisfactory.

The rice crop, which is being harvested in Bombay, Bengal, the Central Provinces, Burma and Assam, is reported good.

Cotton-picking continues in Berar. In Bombay the crop has been damaged in places by excessive rain.

Poppy continues to thrive in Bengal and the North Western Provinces and Oudh.

Sugarcane is being cut in Bengal and promises a fair yield.

Rabi sowing, which have been almost completed throughout the country, have been benefited by the past week's rainfall, and prospects are generally very favourable.

Fever and cholera are still prevalent in Bengal, but elsewhere the public health is satisfactory.

Prices have risen in four districts of the Punjab; and also show an upward tendency in the North-Western Provinces and Oudh. In Mysore and Coorg they are falling, but elsewhere remain generally steady.

For the weeks ending 22nd December 1886.

General Remarks.—There has been slight but seasonable rain during the past week in the Madras Presidency and the Deccan, and local showers in Central India, Rajputana, and Hyderabad.

Some damage has been occasioned by the late heavy rains in a few districts of Madras and Bombay, while in the western districts of the North-Western Provinces more rain would be beneficial, but on the whole the rabi crops are in good condition and promise well. In the Punjab rain is much needed to complete the rabi sowings.

Harvesting of the kharif crops continues in progress in the Bombay districts and Hyderabad, and the winter rice is being reaped in Burma, Bengal, and Assam with prospects of a fair outturn. Elsewhere the autumn harvest has been completed.

Prices are rising in parts of the Punjab and are generally steady elsewhere.

Cholera and fever are still prevalent in Bengal, though less severe, and smallpox exists in Madras, Bombay, and at Peshawar. Elsewhere the public health is fair.

Cattle-disease is reported from Madras, Bombay, Burma and most of the other provinces, but is nowhere serious.

For the week ending 29th December 1886.

General Remarks.—During the past week there has been slight but general rain over the eastern and central districts of the Punjab where the rabi sowings are now nearly completed. In the N.-W. Provinces and Oudh the rabi crops are being irrigated, and though in good condition, would be benefited by rain. Cloudy weather has prevailed in Hyderabad, the Central Provinces, Central India and Rajputana; the crops generally promise well but rain is wanted in Rajputana. Prospects remain favourable in Madras and Mysore, though rain is needed in some districts of the former. In Bombay the standing crops have suffered in places from blight, cloudy weather, and frost. Prospects in Bengal, Burma and Assam continue favourable.

Harvesting of paddy and late kharif crops is proceeding in Madras and Bombay; cotton is being picked in the Central Provinces and Hyderabad; the aman rice harvest is yielding a good outturn in Bengal, and the winter rice is being reaped in Assam.

Prices have risen in a few places in the Punjab and Rajputana; elsewhere they are fairly steady.

Public health is improving in Bengal; cholera and small-pox exist in most provinces, but there is no abnormal sickness.

Cattle-disease is reported from Madras and Bombay.

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DESTRUCTION OF GRAIN WEEVIL.—The black weevil is an insect well known to grain-dealers all the world over, and especially in tropical climates. In India it eats the grain of wheat and maize from the time it is reaped until it is in the hold of the ship, or made into bread and the bread eaten. It will even eat bread after it has been backed. It is also found in every rice, til, wheat, maize, and sorghum godown in India. Like many other insects the black weevil seems to flourish particularly well in Burma. This is owing to the even temperature of the climate as it dislikes the sudden changes to either heat or cold. It is impossible to estimate the amount of damage caused by this insect but it is enormous. A large percentage of the shrinkage in stored grain can properly be attributed to destruction by this insect. It is not detected unless in very large numbers, but when the grain is cleaned by being passed through a fan-mill or winnower, grain which has already been thoroughly clean will show a large amount of dust and a material fallingoff in the weight of the bulk or bin of grain. The peasants try to combat the ravages of this insect by spreading the grain in the sun and then placing gunny cloth on the top of the grain, when the insect, disturbed by the heat of the sun, crawls out of the grain to the top of the cloth and is then shaken off, and the grain returned to the bin. This method of temporarily getting rid of the insect cannot be followed when there is a large amount of grain in store, on account of the expense of handling the grain. Mr. Cabanise of Burma has been trying for several years a number of experiments with the object of finding a cheap and simple method of preventing the ravages of this weevil. He thinks he has found it in the use of naphthaline powder. His method of using the powder is here given for the benefit of the grain-dealers. It is best to place the naphthaline powder at the bottom of the bin or bulk of grain. To accomplish this, take a bamboo about $1\frac{1}{2}$ inches in diameter and long enough to reach from the top to the bottom of the bulk of grain. Punch the joints out of the bamboo so as to be able to pass a stick through from one end of the bamboo to the other. Have the stick made to fit the cavity in the bamboo. Pass the bamboo with the stick in it down through the bulk of grain from the top to the bottom. Withdraw the stick and drop into the top of the bamboo about half a tea-spoon of naphthaline powder. The bamboo can then be drawn out, as the naphthaline is safe at the bottom of the bulk of grain. If the bulks are large, this should be done one to every 10 feet square of the bulk. Repeat the application every 15 or 20 days as the powder evaporates. The weevil that can leave the grain will do so, and those that cannot leave are killed by the odour of the naphthaline. He does not believe that naphthaline thus used can cause any injury whatever to grain. For seed purposes the germinating powers appear not to be affected in the least. For marketable grain the colour is not affected, and the odour will leave in a short time if fresh naphthaline is not applied to it. The quantity of powder used is infinitely small in proportion to the quantity of grain, and the powder is entirely destroyed by evaporation, so that for food purposes the effect is *nil*. Naphthaline powder can be procured at

most medical halls in India at Rs 2-8 per ounce, and a few ounces of it will be sufficient for one season for any grain-dealer.

* *

PROTECTION VERSUS FREE TRADE:—Some of the most advanced countries in the world such as France and Germany have found it expedient to protect native agriculture and manufacture by granting bounties on native products and imposing duties on foreign importations. Very recently the Italian Government has decided to impose a duty on imported grain ranging from about 2s to 7s per quarter with the object of relieving agricultural distress. It is a notorious fact that although the agricultural and working population of India live under a perpetual state of starvation and that in spite of the good will and well meant efforts of the British statesmen during over a century of British rule their state has not in any way improved, our industries have been left to die form the effect of their hard struggle with free trade for which India is not sufficiently strong. The great industry of India, namely agriculture wants careful fostering, no better way of doing which can at present be adopted than to protect it by legislation as more advanced countries have done, and unless this is done, there is no hope for our agriculturists, that is to say, our material progress. India is a poor country, she is not in a position to fully utilize the advantages of free trade, in competition with more advanced countries of the west. No doubt we have through the blessings of British Government got theoretically cheap food and other articles of daily use but where is the money to buy them with. This is the whole question in a nutshell and if the agricultural population of India is not left to be sacrificed to the English hobby of free trade, means will have to be taken sooner or later to protect her agriculture and other industries. Even in England, the home of free trade, a movement has been set on foot to impose duty on foreign importation of grain. The rice millers of England have memorialized or are about to memorialize parliament to increase the rate of export duty on clean rice from Burma and to impose an import duty on the same product in England, with a view to protect the established milling industry in Great Britain and check the same industry which has lately shown signs of rising in Rangoon.

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PRESERVATION OF FRUITS.—Preservation of fruits is more a domestic industry in India than otherwise. Every housewife knows how to make her own jams. But the making of preserves on anything like a manufacturing scale is unknown. In season, certain fruits are produced in such great abundance that the growers can not sell their raw fruits at a profit and having no other means of utilizing them allow them to be wasted. Fruits like mango wood apple etc., can be very well preserved and sold leisurely at profits. The little that is preserved is hardly sufficient for the use of the family in which it is done and no attempt is made to supply the general demand. If we look to the trade reports we find that while annually we export about 2 lakhs rupees worth of fruits and vegetables dried salted or preserved, we import over 25 lakhs rupees worth of the same. Sugar is cheap enough in India to make jam-making business on a wholesale scale a paying one, but owing to want of native enterprize this business has not been started. Let us see what the Americans do with their excess fruits. Jam-making is out of the question in America, at least upon anything like a manufacturing scale, because of the dearness of sugar. So the fruit growers have devised other means of disposing of their surplus fruits. They have erected large establishments furnished with most approved machinery, for the rapid drying and evaporation of the watery parts of the fruits. By an ingenious process the water is slowly separated from the solid parts which at the same time undergo a chemical change, the acid and sugar being converted into grape sugar. Fruits thus treated will keep for a long time and the Commissioner of Agriculture for the United States report that this fruit cannot be distinguished from fresh fruits when cooked and requires only half the quantity of sugar to sweeten it. Not only are there large factories for drying but even the smallest grower have little stoves of this kind and the whole family is employed in slicing and coring apples or preparing soft fruits, previous to the process of drying. That these means are efficacious and widely adopted is shown by the fact that in 1885, no less than 1,860,986 lbs of fruit preserved without sugar were imported into Great Britain from the United States together with 10,559 cwt of dried fruit. Surely it would pay us over and over again to take a leaf out of the American book and in a true commercial spirit to prepare our produce in the form best calculated to sell it to advantage. In these days of hard struggle for existence, enterprize will have to be directed in such new channels.

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MR. OLPHERT ON INDIGO:—Unlike the actual cultivation of it, the manufacture of indigo admits of great improvement. Fully appreciating this fact, an old Anglo-Indian has for some years devoted himself to the discovery of more scientific methods of manufacture. He suggests instead of cutting the whole plant, removing only the color producing portions of the plants, namely the leaves and tender

branches bearing the leaves, and carrying them in wire-work cases to the steeping vats. On arrival at the factory, these cases are lifted into the steeping vats watered to receive them together with their contents. His next suggestion is to stir the plants when in the steeping vat, thus doing away with the separate oxidizing vat; and, after the liquor is run off, to slightly press the leaves to compel them to part with any remaining coloring matter. His third suggestion is to plunge, after steeping and pressing, the wire work cases with their contents into water ready for steeping the next batch of leaves. This helps the fermentation of the new leaves. His fifth suggestion is to skim off mucilage and other foreign matter thrown off during boiling the mal Few planters do this, lest it would diminish weight, but also because they have no appliances for the purpose. Mr. Olphert has supplied this want. He has also modified the straining table works to get a perfect drainage which secures uniform indigo cakes. Passing to the next operation, Mr. Olphert uses a press with a metal frame but without the usual lining. Instead of working from the top, the screw is operated from below, the advantage being that one man can do the work of ten and the blocks of indigo are not broken. We are told that Mr. Olphert's new proposals will not necessitate any great alternation in the existing plant of indigo factories. We are indebted to our contemporary of the *Indian Planter's Gazette* for this information.

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OBITUARY :—We are deeply grieved to announce the untimely death of Henry Michael Jenkins, the Secretary of the Royal Agricultural Society of England and Editor of the Society's Journal Any chronicle of current agricultural topics would be incomplete without a reference to the irreparable loss sustained by not merely English, but international agriculture in the lamentably early death of Mr. Jenkins. He was a man of education, of scientific habit of mind and of wide reading in many branches of Science. He had acquired during his eighteen years of official work a knowledge of the details of farm management that would not discredit a life long farmer and that many life long farmers never attain. He occupied the foremost position among the most advanced authorities on dairying in general and at buttermaking in particular. He was an accomplished linguist and had travelled much in France, Germany, Belgium, Holland and Denmark. During his travel, he had amassed more knowledge than any living man of the agriculture of those countries. The blue book on Agricultural Education, which he compiled for the Commission on Technical Education, is one of the concentrated and formidable isolated examples of his industry. But of those who for nearly twenty years have read from time to time his long succession of masterly reports in the Society's Journals, which he so ably edited, can duly appreciate the intensely practical value of his literary work. During his editorship the Journal of the Society has become one of the most popular books with all who are connected with agriculture. Were it only in recognition of his services in connection with the clearing of the United Kingdom of Foot and Mouth Disease, Mr. Jenkins deserves to be remembered by all classes of the community. At that time it was difficult to obtain accurate information on the matter, as only those in charge of their cattle were allowed to travel on board the cattle steamers plying between England and Ireland. Mr. Jenkins dressed as a cattle drover made eight voyages in cattle steamers between the two countries and was enabled to make himself thoroughly acquainted with every details of the cattle traffic. One of his best known works we are told is associated with an amusing incident. During a railway journey, Mr. Jenkins fell into conversation with a stranger and the talk gradually veered round to the subject of dairying. Mr. Jenkins finding him well informed on the subject began plying his companion with questions, till eventually the latter taking out from his pocket a pamphlet which he handed to Mr. Jenkins said, "Read this, it will tell you more about the matter than I can. You may keep that Sir; I always have few on hand to give away to any body who is interested in the matter.The Pamphlet was "Hints on Butter-making" by H. M Jenkins F. G. S. A life of such usefulness succumbed on December 24, to asthma which had been troubling him ever since his boyhood. His untimely death will be mourned by a large circle of friends and agriculturists not only in England and on the Continent but also in India. His funeral took place at the old village church of East Barnet where he was born in 1841. The coffin was covered with wreaths, among them one from the late hard working President of the Society, the Prince of Wales.

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RUSSIANS WHEAT :—According to the report of the Russian Minister of Agriculture the deficiency on the winter wheat crop of 1886 was abut 27 per cent. as compared with the averages of the last four years, but an increase of about 4 per cent. on spring wheat averaged over the same period. The figures rendered for the crop of 1886 are as follws.—Winter wheat 4,536 000 qrs., spring wheat 19,440 000 qrs., together 21,-976,000 qrs.; against 9,260,000 qrs., of winter

wheat and 12,096,000 qrs. spring wh·a', together 2·,464 000 qrs. in 1885. Consequently the wheat crop of Russia though considerably under the average of the last four years, according to the official statement, was still 512,000 qrs. in excess of that of 1885. All the other cereal crops of 1886 are represented to have been above the average of the past four years.

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THE DISTRIBUTION OF NITRIFYING ORGANISMS IN THE SOIL: By R. WARINGTON F. C. S.—The result of 69 experiments with clay or loamy soil from various depths shows that the nitrifying agent is present almost without exception down to 3 feet from the surface; samples from below this depth did not always exhibit the power of causing nitrification, and none of the samples of soil taken 8 feet from the surface produced nitrification. The nitrifying organism present in the subsoil is apparently in a feeble condition, nitrification starting much later in solutions seeded with subsoil than in those seeded with surface soil. Reasons are given for believing that in agriculture, nitrification is practically confined to the surface soil. The nitrogeneous matter present in the subsoil is however, nitrifiable if exposed to favourable conditions. Dr. Percy Frankland remarked that it appeared desirable to use a nutritive material more constant in composition than urine in experiments on nitrification. He objected to the term "nitrifying organisms:" Heraeus, in Berlin, having recently proved that there were a considerably number of organisms capable of inducing nitrification. Mr. Warington said that, however unfit urine might be for a certain class of experiments, as the object he had in view was to ascertain if nitrifying organisms were present, he maintained that it was sufficient to have an easily nitrifiable solution. The question was ask d—were nitrifying organisms present in essentially siliceous soils? He had no experience except with Rothamsted soils, but he should say that they were if such soils were found to contain nitrates; moreover, Muntz had shown that if the organisms once become established in a bed, whatever its nature, it becomes more or less capable of effecting nitrification in suitable liquids passed through it.

* * *

FRANCE.—The application of hydropathic treatment in the stable has become an accomplished fact in France. The fact has long been recognised that the application of water in health stimulates the equine skin and increases vascular energy, while in disease it is indicated in many affections. Many both men and boys, have watched the sportive gambols of the horses when ridden into the tidal shallows at early morn. But it has been reserved for M. Adrien Purson, of Stenay (Meuse), to adapt the bath of civilisation to the needs of the horse. This he does in two forms one permitting of the immersion of the animal up to the shoulder, and made to height varying from 0·90 to 1·65 inches. The price varies in proportion to size, from 4 to 6£. The second from is adapted for the application of either cold and warm water to the limbs. Both varieties are capable of being fixed so as to prevent any injury from abrasion or friction. Silver medals and honourable mention were gained by the apparatus at the only two shows as yet available for its display. those, namely, of Stenay and Etain. The agent in Paris is M. Fromage, 20, Rue Lebrun. The officers of the National Agricultural Society of France for the year 1887 are—President, M. E. Lecouteux; Vice-President, M. Chevreul; Secretary, M. L Passy; Vice-Secretary, M. Bouquet de la Grye; Treasurer, M. Beatin. Official returns give the total vintage of 1886 as 594,270 000 gallons, the produce of nearly five million acres. This is less than one third of the crop of 1876. The cider yield reached a total of 182,030,000 gals., or only 40 per cent. of the excellent crop of 1885. The agricultural society of Vosune have not only established four experimental fields, but have offered medals and cash prizes during the coming show season to those who establish such fields under the conditions set forth by the departmental professor of agriculture. Three private individuals have already responded by inaugurating such fields on their domains; and much benefit may be anticipated from the lessons thus learnt of the superior advantage of cleaned seeds and high-class fertilisers.

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TRAFFIC RETURNS OF THE NORTH-WESTERN PROVINCES AND OUDH FOR THE QUARTER ENDING 30TH SEPTEMBER, 1886.—The weight of the principal commodities which these Provinces sent out by rail to the ports and the neighbouring provinces and states amounted to 47½ lakhs of maunds and the imports amounted to 43 lakhs of maunds. Compared with the traffic of the corresponding quarter of 1885, the following are the only points which require noticing:—(1) Decrease in the exports of wheat, (2) Increase in the exports of cotton and linseed. (3) Increase in the imports of Sambhar salt. The exports of wheat in the present quarter amounted to a little over 19 lakhs of maunds; in the corresponding quarter of 1885 they had amounted to 24½ lakhs of maunds. The falling-off is due to the crop of 1886 being not so good as that of 1885, which raised local prices, especially in districts of the Meerut Division, which supply the greater portion of the soft white wheat sent to Europe. The

exports of cotton and linseed were larger by 52 thousand and 91 thousand maunds respectively than in the corresponding quarter last year. The cause of this increase was noticed in the preceding quarterly returns. The imports of Sambhar salt amounted to 5,73 857 maunds, against 4,17,410 maunds in 1885-86 The increase is due to a reduction of 4 annas per maund in its price at the lake. It has led to a corresponding decrease in the import of Bargana salt from the Bombay Presidency, which had supplied the place of sambhar for more than a year when the supply from sambhar had fallen off owing to the floods of 1884-85. The registration of canal traffic, as noticed in the preceding quarter, ceased from the 1st August 1886; registration of traffic by the river Ganges was given up, with the concurrence of the Bengal Government, from the same date; the only traffic which, therefore, remains to be noticed is that transacted by these Provinces with Bengal by the river Gogra. The total traffic by this stream amounted to 22 lakhs of maunds; of this the exports constituted over 20 lakhs of maunds, the principal exports being wheat and other grains, oil-seeds, and sugar: the imports consisted chiefly of salt, iron, and tobacco. The total traffic by this stream during the corresponding quarter of 1885 had amounted to 25½ lakhs of maunds, the decrease in the present quarter being caused by a diminished export of grain.

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ROYAL AGRICULTURAL COLLEGE:—The Winter Session of the Royal Agricultural College, Cirencester, terminated on Wednesday, the 22nd January when the Principal, the Rev. J. B. M'Clellan, distributed thediplomas, etc., in the College Hall. He congratulated the College on the admirable year's work just concluded, and referred to the additional advantages in practical agriculture which it had this year placed at the command of its student. Among the recent honours gained by students of the College, it was mentioned that the first place in the Royal Agriculture Society of Ireland's Examination for diplomas, etc., open to all-comers, had been obtained by Mr. N. A. Banerjea, an Indian student of the College, and Bengal agricultural scholar who was awarded the special diploma of the Society and the silver medal. Referring to the examination for the College diploma, the Principal said the external examiners had been (*a*) in Practical Agriculture: Mr. Arthur Gibson, Bulwell, Notts, and Mr. J. T. F. Jackson, Tattenhall, Cheshire; and (*b*) in Agricultural Chemistry: Dr. J. A. Voelcker. The reports of these gentlemen and of the eight professors of the College were highly satisfactory. Among the awards was the Diploma of Membership to Edward B. Steedman, High Ercall Hall, Wellington, Salop, Indian Civil Service; George Carrington, Missenden Abbey, Bucks; and William R. Richardson Colly urst Lodge, Manchester. The Haygarth Gold Medal was awarded to Edward B. Steedman.

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LAC INDUSTRY.—"This is a most lucrative industry, and is carried on only in the districts of Bankoora and Beerbhoom. Sonamukhi is the chief centre of it in Bankoora, containing about 75 factories, which annually turn out 11,000 maunds of shell lac, and give employment to about 5,000 men daily. There are five factories at Mejia and five at Rajgram, which produce about 9,000 maunds of lac. Elambazar is the seat of the lac industry in Beerbhoom. Two thousand seven hundred maunds of shell-lac and toys to the value of Rs. 67,000 were made against 2,300 maunds, valued at Rs. 46,000, in previous year, which shows a considerable improvement.

* * *

CURING BACON AND HAMS.—It is a well-known fact that Yorkshire hams are more popular than any other, not only in England, but also on the Continent; therefore, if any one wishes to obtain really good bacon and ham he cannot do better than follow the Yorkshire method, which is as follows:—We will suppose, for the sake of convenience, that a pig weighing twenty stones is the one in question. After being killed, let the pig hang for twenty-four hours previous to being cut up; then rub into it, very thoroughly, one pound of saltpetre and two stones of common salt. Place it in a tub, proper for the purpose, and leave it untouched for a fortnight; at the end of that time it must be turned over—the position of each piece being carefully reserved—and left in the brine for a fortnight longer. It may then be drained and hung up in a warm room to dry. When this stage has been reached take both bacon and ham down, wash the inside parts over with quicklime and water, to preserve it from fly-blows, and hang the several pieces from the ceiling of a cool, airy room—one not used by the family, of course. When perfectly dry it is ready for use. It is quite possible to smoke hams and flitches of bacon at home by hanging them up chimney where only would is burnt. The best kind of wood is oak and its sawdust, if it can be procured; fir or deal must never be used. But when the business has to be performed on a large scale, it will be found much better to adopt the plan followed in Hamburg. They hang the hams and bacon in a large roomy chamber at the top of a high building, the smoke being conveyed to this room, or rooms, as the case may be, through tubes

from fires in the cellar. The vapour is thus condensed and the heat absorbed, so that the smoke, when it reaches the meat, is dry and cool, and in consequence, it imparts a flavour by far superior to that obtained by the commoner method. An excellent way to keep both bacon and hams after being smoked is to put them into large chests filled with bran; this plan will prevent them becoming rusty, and will also protect them from maggots.

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PEPPER CULTIVATION IN MALABAR.—The pepper vine grows plentifully about every valley among the hills delighting in a moist rich soil. It it indigenous to the forests of Travancore and Malabar. So valuable an article of commerce is pepper considered, that the Maplahs, the commercial class of Malabar, call it the "Black Pearl." Although a product of many countries such as Sumatra, Bali, Malacca Penang, Siam, Singapore and some of the islands of the Indian Archipelago, the pepper produced in Malabar, more especially that which comes from the Taluqus of Cherakal and Kottayam is commonly acknowledged to be the best. The cultivation of pepper is more extensively carried on in North Malabar than in South Malabar. The soil most esteemed for pepper is red soil containing small stones. Above all the vine loves a moist climate. The vines are chiefly planted on the hill sides but thrive well enough in the low country in the moist climate of Malabar. Pepper is propagated by cuttings or suckers, and is planted before the commencement of the rains in June. They are usually planted near trees which have rough bark. The creepers are trained on a great variety of trees, but the one in most common use is the Muricca or the *Erythrina Indica*. *Erythrina Indica* can be easily propagated by cuttings and is a fairly rapid grower and further it has the advantrge of having a rough and prickly bark. It would grow equally well on other trees which have rough barks, such as the mango, jack, &c.,

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The manner of forming a plantation of pepper upon the Muricca is as follows: The land must be cleared of all scrub jungle and then fenced with a mud wall, and levelled into terraces. Between July and November, dig the ground deep with a hoe and plant plantain shoots 4 or 5 feet apart. Then just immediately after two or three showers of the heavy monsoon, plant branches of Muricca. These branches should be from 6 to 8 feet long; straight branches having a golden colour at the bottom should be preferred. Pepper does not thrive well when planted too close. An acre of land will in round number have 1,200 plants and as the vines require but little care, the cost of cultivating and manuring the crop per acre does not exceed Rs. 500 or 600; and as the annual yield when the plants come into full bearing is worth upwards of 1,000 Rs the investment certainly is a very profitable one. Between the middle of May and the middle of June, the vines are planted, which may be done in two ways. Some people take 5 or 6 cuttings, each of cubit in length and put them in a basket with their upper end slanting towards the tree. The basket is then filled with fine mould and buried in the ground at the foot of the tree and after a lapse of three or four months the earth round the basket is dug and dry leaves and cow-dung are then put round the vines as manure. Some people plant the cuttings round the tree without any basket It is said that the basket prevents many accidents to which young roots are liable, so that, of those plants which have this protection, much fewer die than those which have it not. The former process is, of course, more expensive. Whichever manner of planting the shoots may be adopted, there is not much difference in the after treatment. During the dry season for one or two years after planting, the vines must be watered; in favourable soils once in three days, in dry soils every other day. But in large plantations, on hill-sides especially, it is indeed very difficult to water the plants. In such cases the authorities adopt a peculiar system which somewhat corresponds to mulching. They carefully cover the tender vines with small bushy branches and thus protect the young shoots from the scorching sun. About the end of October and the beginning of November the plants must be manured if possible, and carefully tied up to the tree until they are 10 or 12 feet high, after which they are able to support themselves. In the 4th year the plantains which in the meantime have served to afford shade to the growing vines, are all dug up and not less than twice a year the whole plantation must be hoed and dry leaves put as a sort of manure round the roots of the vines. During the growth of the plants, it is necessary to remove all suckers and the vines should be pruned, thinned and kept clear of weeds. The branches of Erythrina must also bepruned during the months of March and April and the soil must be well stirred and loosened just after the commencement of the monsoon. If pruning is neglected, the crop will not be good. The cultivators do not generally use any special manure for the plant, but at the beginning of the monsoon, some leaves, ashes, and dung are spread on the ground near the roots of the vine. If the suckers or shoots are good and healthy, 4 to 6 ,will be quite sufficient for a tree. These suckers are ge-

nerally cut about the middle of June. The shoots which are a cubit long cost 3 to 6 rupees a thousand and the branches of Erythrina have, of late, become very dear. They cost about Rs. 60 to 80 a thousand.

The pepper vine begins to bear at 4 or 5 years of age, and in three more years it is in full bearing, and continues to yield a full crop for 30 or 35 years when the Muricka dies and must be replaced by a fresh branch and new vines. Under the best mode of cultivation and with the most congenial soil the vines become unhealthy and are never profitable when they are old. The period during which a plantation will remain in full bearing, depends, of course, on a variety of circumstances, but with the most careful treatment consistent with profit, the vines will not do much good after they are 30 or 40 years old. The pepper vine is capable of growing to a height of 30 or 35 feet, but for the sake of convenience and for the facility of collecting the berry it is usually kept down. When the fruit is intended for black pepper, it is not allowed to ripen fully but is collected as soon as the berries become hard and firm, which happens between the middle of January and that of February. If they are colected too early they will spoil, and so, much experience is required to know the exact time.

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The men who collect the pepper go up the bamboo ladders and with their fingers twist off the amenta and on very rare occasions strip off the berries. They collect the fruit in a bag or basket and having placed it on the ground, rub it with their feet to separate the berries from the amenta. The bad berries having been thrown away, the good ones are spread on mats or on a piece of ground made smooth, so that one berry does not lie upon another. For three days they are thus spread out in the sun, but every night are gathered and taken into the house. Drying on mats is by far the best method. 15 Malabar seers of pepper dried on mats will weigh a tulam or maund while 16 Malabar seers of pepper dried on the ground will weigh up no more. A man can daily gather and cure from 14 to 18 Madras measures according as the crop is less or more plentiful. A man will, therefore, on an average collect half a tulam a day and the drying and rubbing out of the berries is frequently performed by children and with their assistance a tulam may be collected. A prudent man who does not receive advance for his pepper sells at from 10 to 12 rupees a tulam, or from 200 to 240 rupees a candy. It may not be quite irrelevant here to notice that the price of pepper has of late been nearly doubled. Twenty years ago the price per candy was never more than 120 or 130 Rs. This year some of the great planters of Malabar have sold many candies of pepper at 270 rupees per candy!!

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Each vine yields on an average 4 or 5 lbs. of pepper per annum up to 30 or 35 years, after which it begins to decline. The small round berry grows somewhat loosely to the number of 20 or 30 on a common pendulous fruit stalk. The fruits are at first green, then become red, and if allowed to ripen, yellow, but as I have said before they are gathered before they are quite mature and by drying in that state turn blackish-grey. White pepper is the same fruit freed from its outer skin, the ripe berries being macerated in water for the purpose. In the latter state they are smaller, of greyish white colour and have a less aromatic or pungent taste. If white pepper is wanted, the berries are allowed to become quite ripe. The vines in this case are very apt to die and in our part of Malabar white pepper is little produced. Besides being propagated by shoots or suckers, pepper can also be raised from seed and experienced men prefer this mode of propagation because, they say, the vine so raised bears well for 40 or 45 years; on the other hand though the cuttings yield well only for 25 or 30 years, the crops they give after their maturity are decidedly greater and the berries are both of large size and of superior quality. Moreover vines raised from seed take a much longer time to bear. It is for this reason, therefore, that in Malabar the propagation is effected by cuttings. Pepper is one the most wholesome and useful of spices and the Malayalees esteem it so much that we can scarcely find a single garden without, at the least, 20 or 25 trees having thin foliage and straight stems such as teak, jack-trees, &c., which are intended as supporters for this valuable plant. We are indebted for the notes to our valuable agricultural contemporary of Madras.

Read the advertisement of the Game Fowl Monthly, a Journal devoted wholly to the game fowls published by C. L. Fancisco, Rushville N. Y. The journal will be a valuable guide to those who are interested in breeding and rearing game fowls.

THE CHRISTMAS TURKEY.

That all
you good people
at Christmas may dine, I
gladly the pleasure of living
resign, and hereby declare my last
Will, and who tries to break it
will forfeit the dinner he'll prize. Now, known
by these presents, that I, Thomas Turk,
leav- ing nothing for people too lazy
to work, desire to be stuffed and
cremated with care, and skilfully
carved so that each gets his
share. My drum sticks I give to two nice
little boys in hopes they will add many "pounds" to their
joys; my "wish bone" must go to a sweet little maid who's wish
will by Fairies be surely obeyed; my wings, heart, and breast to the
ladies must go, with plenty of "dressing" which pleases them so.
My dark meat and gizzard and liver so fine to men, if they're
thankful, I duly assign; to the carver, provided he's carved "on
the square," I leave my own "Turk's cap" he proudly may
wear. And, now, if I happen, alas, to be tough, or,
being so hungry, you don't get enough, please fill
up with plum-pudding, mellow and old, and with all the
good things you ever can hold. But value this Tur-
key's Christmas bequest, who for you jest dies so
you all may
digest.

H. C. Dodge.

The above is taken from the Christmas number of the Scottish Agricultural Gazette.

1 Report on the river-borne trade of Assam for the year ending 31st March 1886: From the Assam Government

2 Journal of the Agricultural Student's Association for September 1886: From the Association.

3 Memorandum on the Prospects of the Wheat Crop in the Punjab: From the Government of India.

4 Note by F. W. Cabaniss on the Prevention and destruction of Black Weevil in Grain bins, and Godowns: From the Government of India.

5 Memorandum on the Prospects of Rice Crop in Burma up to 31st December 1886: From the Government of India.

6 Memorandum on Wheat Crop in the Central Provinces: From the Government of India.

7 Returns of the rail-borne Traffic of the Central Provinces for the quarter ending 30th September 1886: From the Central Provinces.

8 Proceedings of the Agricultural and Horticultural society of India for December 1886: From the Secretary.

9 Memorandum on the Prospects of the Oilseed Crops in the Punjab; From the Government of India

10 First General Memorandum on the Prospects of the Indian Wheat Crop of the season 1886-87; From the Government of India

11 Report on the External Land Trade of the Punjab for the year 1885-86: From the Punjab Government

12 Returns of the rail-borne Trade of Bengal during the quarter ending the 30th September 1886: From the Government of Bengal.

13 Report on the rail-borne Traffic of Bengal during the year 1885-86. From the Government of Bengal.

14 Report on the River-borne Trade of Assam for the quarter ending the 30th september 1886: From the Assam Government.

15 Abstract Comparative statement for the previous quarter ending 30th June 1886: From the Assam Government.

16 Report regarding the Travelling shows of Agricultural Implements; From the Madras Government.

Thanks of the Editor are recorded for the above contributions:

THE BENGAL AGRICULTURAL SCHOLARS.

The Government of Bengal under Sir Ashley Eden founded in August 1880 two Scholarships of £200 each tenable for two years and a half at the Royal Agricultural College at Cirencester by Graduates of the University of Calcutta who have passed their B. A. on the physical side. A good number of candidates applied for them. A Committee of five members headed by the Director of Public Instruction was appointed to send in the names of two candidates whom they would nominate to the Scholarships, the approval of the nomination so made resting with the Government. The first two graduates appointed to the Scholarships from January 1881 were Mr. Ambica Charan Sen, M. A., and Mr. Sukhawat Hossen B. A., of whom the former graduated from the Presidency College and was at the time of his appointment to the Scholarship serving the Government in the Education Department for nearly eight years as Lecturer in Chemistry at the Krishnaghur College, and the latter graduated from the Hugli College. When Messrs. Sen and Hossen had been one full year attending the course of Agricultural lectures at the Cirencester College, two more were appointed to the Scholarships viz.. Mr. Giris Chandra Bose M. A and Mr. Byomkes Chakravarti M. A. of whom the former graduated from the Hugli College and was at the time of his appointment to the scholarship serving the Government in the Education Department for about six years as Lecturer in Botany and Chemistry at the Katak College and the latter graduated from the Presidency College and serving the Government in the same department for about two years at the Sheebpur Engineering College. When the first batch of Scholars namely, Messrs Sen and Hossen were on the eve of their departure from England after completion of their full course of agricultural study, and the second batch just a year old in the college, the third batch of scholars was sent up namely, Mr. Atul Krishna Ray, M.A., and Mr Bhupal Chandra Basu, B. A., of whom the former graduated from the Hugli College and was serving in the Education Department for about a year when appointed to the Scholarship and the latter graduated from the Presidency College and was on the eve of going in for his Master of Arts Examination.

Messrs. Sen and Hossen came back to India in August 1883, when four more scholars, as has already been shown above, had proceeded to England without any knowledge of the kind of reception which Messrs. Sen and Hossen would meet with on their return and which was to be the fate of their successors as well.

Meanwhile the time for appointing the agricultural scholars for 1884 came and passed, and it was generally believed the cold reception of Messrs Sen and Hossen scared away the candidates. In January 1884 the Government of Bengal thought fit to appoint Mr. Sen to the Satutory Civil Service and in March of the same year Mr. Hossen was appointed to the Subordinate Executive service. Both of them had passed the examinations of the Royal Agricultural College very creditably, but the discriminating eyes of the Government found out a difference to deal out to them different rewards and it is not for us to impugn the wisdom of the step taken by the Government. The reception accorded to the first batch of returned Cirencester-men, disabused the minds of the future candidates and the really first class men amongst them stayed away ever since from applying for the scholarships which have since been awarded for the mere asking. They were we hear offered to many and not accepted ; some even went further, they threw them up after accepting. We know of one instance in which one year one of these scholarships was thrown up by one candidate after accepting and then accepted again by the same man after the lapse of one year. The scholarships in fact, since the appointment of the first three batch of students and the return of the first batch from amongst them, have virtually gone a-begging.

We have already spoken how Messrs. Sen and Hossen have been provided on their return, but those were the days of nomination and not competition. But times have altered since then. Mr G. C. Bose returned from England, in July 1884, Mr A. K. Ray in July 1885, Mr B. C. Basu in November 1885, and Mr B Chakravarti in July 1886 all of whom had proceeded to England before any of our young men from Cirencester returned.

On the return of Messrs. Sen and Hossen in 1883 and afterwards of Mr. Bose in 1884, Government published in the local Gazette the despatches of the Secretary of State for India embodying the testimonials acquired by them at the Royal Agricultural College and cognate Societies in England which speak for themselves and to which we need not allude here. In the case of later arrivals, however, the same practice has not been followed although their testimonials were equally hard won and handsome. The case of Mr B. C. Basu deserves special mention. The Government of Bengal at the instance of the India Office gave him a special grant for studying Agriculture and Agricultural Economics on the Continent and the fruits of his labour were embodied in a series of interesting reports published by the India Office.

But all these despatches, testimonials and reports were of little avail when they came back to India. They lacked that element of preference which backs local claims. The Government was certainly not under any distinct promise to provide them with appointments but that it had a strong moral obligation to do so, will be acknowledged by any one who has gone through the papers from which we can show that the Government did give them some kind of promise. We do not however wish to press that point at present.

Allowing them to vegetate since 1884, very recently they were offered the choice of accepting apprenticeships in settlement work in the Central Provinces on a monthly salary of the remarkable sum of Rs 200 till March 1887, with a promise of being maintained, there being no mention how or on what salary, till 1888, when as vacancies will arise they will be drafted into the regular Bengal staff, by which they mean the Subordinate Executive Service. This offer however scanty it might be was not made for the last three years and would perhaps have not been made at all, if it were not for the kind interest taken in them by Sir Edward Buck and Mr Finucane. We understand that Sir Edward has taken upon his own department the charge of defraying their expenses while engaged in learning settlement work in the Central Provinces. In these days of hard struggle for existence we do not wonder that some amongst them have accepted service under Government on the proposed terms, but the handsome prospect of a prospective Deputy Collector sometime in the year of grace 1888 did not offer sufficient inducement to others, who we understand have thankfully declined it. They have of course their own reasons for accepting or declining but what strikes us as most strange is the way in which Education in England has been discounted by Government.

These young men most of whom had a bright University career before proceeding to England, in virtue of which in fact they had been appointed to be scholarships, have not even been thought fit to be at once taken into the Subordinate Executive Service but left to wait like Micawber for something to turn up. A plea was set up that all the appointments in the said service for the present year have been advertised for, intimating thereby that no appointment could therefore be given this year without examination. But before a week elapsed since furbishing this examination fad before these young men from Cirencester, no less than half a dozen appointments were given away without examinations. Even the Calcutta Gazette of the past week published a subordinate executive appointment without examination.

Some of these young men we hear spoke to the Lieutenant Governor for appointment under the rules of the Statutory Civil Service but were gagged by the stereotyped reply that no other door for entering the service is now open than competitive examination. But here again competition has given way to nomination and we need not refer to the instance as it is still fresh in the minds of the public. People get naturally vexed and lose faith when shifts of this order are resorted to. In thus ignoring the claims of the returned Cirencester graduates, the Government stultifies itself and the education it has been at such a great cost to give them. But supposing for argument's sake that the education which they have received in England is not worth much, still they were no mere noodles or scapegraces before proceeding to England.

THE BENGAL AGRICULTURAL DEPARTMENT.

A separate bureau of Agriculture which had been already in existence in the sister Provinces, was sanctioned for Bengal by the Secretary of State for a period of two years from January 1885, and placed under the charge of Mr Finucane as its Director. The function of the newly created office were defined in a Resolution issued by the Government of Bengal May 2, 1885. It was stated that Mr Finucane's work would be of two kinds—Agricultural research, including the arrangements for the experimental survey in Mozufferpore district and for the maintenance of village records; and Agricultural improvements. Mr. Finucane has now submitted a report on the operations of his Department from the date of its creation to the end of July 1886 and the Government of Bengal has recorded a resolution on his report. We shall deal with the report separately; at present we only mean to confine ourselves to the points noted in the resolution.

The first point which calls for special notice is the experimental survey, under the supervision of Mr Finucane, of a part of the district of Mozufferpore with a view to the preparation of full record of rights founded on the survey. The operations undertaken were of an experimental nature to be subsequently extended to a wider area, if found successful. Four hundred and thirteen square miles were surveyed up to the end of July 1886 and a record of rights was made in respect to the holdings of 26,128 ryots of whom 8·26 per cent were settled ryots. The result of the measure, so far as

it has gone, shows that the average area held by a ryot was three acres, and the cost of survey was nearly 9 annas per acre including certain initial expenses. The total cost of survey and settlement at the conclusion of the work would not, as estimated by the Director, exceed 8½ annas an acre—certainly a moderate price to pay for permanent record securing the interests of all parties. Fears were entertained in the beginning that the operations of the kind contemplated by the Government would involve the country in ruinous amount of litigation but the results so far as they have gone have proved that the fears were groundless. There was no opposition to the survey nor friction in carrying it out. The survey in question has been stopped under the orders of the Secretary of State but the facts elicited during the late operation will materially help to modify the views of the anti-survey party when in future the subject will be again taken in hand.

Our esteemed contemporary of the Hindu Patriot fails to perceive how this comes under Agriculture and seems to be in trouble about the existing elaborate revenue survey settlement being thrown out of sight. He plumes himself on being a genuine friend of the poor ryots and scrupulously averse to uselessly costly departments and agencies. We beg to point out to him that the professional agency of the Revenue survey settlement is ruinously expensive and therefore sparingly resorted to. The professional agency is only utilized to survey the boundaries of every village and mouza, and to prepare skeleton maps, to be afterwards surveyed in detail and filled in by less expensive surveyors or mandals trained up and maintained by the Agricultural Departments. With these accurate field maps as basis the work of settlement is proceeded with and finished, and records maintained up to date by and under the supervision of the officers of the Agricultural Departments. It goes without saying that a special agricultural knowledge is essential in those officers who have to deal with the classification of soils according to their nature, the formation of estimates of outturn of field crops, and cognate subjects. Herein lies the usefulness of placing the survey and the settlement works under Agricultural Departments.

A great number of agricultural experiments were made during the year under skilled supervision of the Cirencester graduates and with the co-operation of Zemindars and cultivators. In this connection the Lieutenant-Governor remarks, "that in Bengal more, perhaps, than in other parts of India, there exists a large class of educated men connected with agriculture by their daily pursuits and ready, when properly approached, to work with official experts for the purpose of ascertaining facts, testing supposed improvements and diffusing useful information, and that in this respect Bengal is probably the most promising field yet opened to the Agricultural Department." It is customary with some to discount before the eyes of the public all attempts at improving Indian agriculture and to try to confirm their statements by a piece of apparently sound logic—that the practice of farming is one thing and the science of it quite another. They apparently forget that they create a breach where there is none, that science and practice are parts of one great whole, and as such cannot exist without mutual help and co-operation. Efforts by the official experts to advance the agricultural practices in their districts through the medium of the ryots and Zemindars, are intended to show the latter more profitable way of cropping and some of our contemporaries are crying themselves hoarse to denounce their efforts as theoretical quite unmindful of the first principle that science advances practice and vice versa. The "irresponsible theorists" of our contemporary of the Hindu Patriot are perhaps more responsible for their advice and more conversant with what they are doing and advising than our *sub junta* so called responsible contemporary.

It is a misfortune peculiar to India, and to Bengal in particular, that persons who are least fitted to pronounce an opinion on any subject are often found most forward to pose as authorities and to apparently carry the unwary with them. Whenever talking on agriculture or subjects remotely connected with agriculture, our contemporary invariably refers to an unfortunate "expert in English farming who has admitted that the Indian ryot has little or nothing to learn from Cirencester," an expert perhaps who has as much knowledge of the Indian ryot and Cirencester as a man in the moon. Having a keen sense of the ludicrous, he ought to be aware that he is quoting his expert to ludicrousness. Our contemporary who is a mine of information, who has lately shown wider sympathies with the signs of our times visible on all sides, and for whom we have the highest respect, has taken up quite an adverse position with reference to questions of agriculture and agricultural improvements. He has all along been doing a work of destruction in connection with the agricultural department; but he would do a great service to the department and to the public along with it if he lends himself to the work of construction for which he is so eminently fitted.

It is customary to stigmatize the Indian ryot as very conservative but the readiness with which they have accepted improvements in certain districts of Bengal shows that when properly approached

and convinced of its importance, they are not slow to follow the tide of progress. In Burdwan Division oil cake is largely used by ryots as a manure in the cultivation of paddy with excellent results, while in many other parts of the country the practice is unknown. Similarly, the system of green manuring by ploughing in a crop of indigo, *sunn* or *dhainchi*, of which a good deal has been written, is found to be actually practised by ryots in parts of Burdwan and Hooghly, in the Jamalpur sub-division of Mymensingh, and it may be practised in other places also. Again, the Mauritius system of cultivating sugarcane, the superior advantages of which have been tested by experience and strongly recommended by Messrs. Mylne and Thompsoh of Beheea, is known and practised on the banks of the Damoodar and among the market gardeners in the neighbourhoods of Dacca and Calcutta. All the practices just metioned are, on the other hand, unknown in the Bhagulpur and in the greater part of the Patna Division. A special department, even if it eschewed western innovations on existing practices altogether, can do much good by introducing in such places as Bhagulpur and Patna the practices proved by experience to be beneficial in Burdwan or Mymensingh. Efforts have from time to time been made to improve the quality of Bengal wheat, by introducing seed from Mozuffernagar and Delhi in ignorance of the fact that the very best wheat in all India, known as Buxar No. 1 club is largely produced and exported from the Buxar and Sasseram sub-divisions of Shahabad in Behar. The Buxar seed was introduced into Bhagulpur, and yielded a grain 6 annas a maund superior in value to the local Bhagulpur grain. Applications for some hundreds of maunds of Buxar seed have since been received from various landholders in the Bhagulpur and other divisions for experimental cultivation of the species. Here inquiry and knowledge of the facts elicited by it has shown the way to one very tangible and important improvement.

The waste is greatly to be deplored of bones the best substance for restoring the phosphoric acid which every crop takes out of the soil. The bones were formerly suffered to lie where they might be of some little use, but are now collected, gratuitously ground into meal at Bally and elsewhere, and exported to Europe to the great detriment of Indian agriculture. Greater success has been obtained in the Burdwan district. Bone-meal was distributed in small quantities among selected talookdars in Burdwan, and was used as manure on rice and other crops with beneficial results. People have taken kindly to it. They also use horn shaving as manure for paddy and other crops.

Owing to the absence of a village agency—a want which affects the Government of Bengal in every effort towards administrative reform—it is impossible for the department to prepare for Bengal returns of the area sown with each crop, as is done in other provinces. As regards agricultural statistics there is no agency either for their collection.

Agricultural exhibitions properly conducted are a great means of popularizing agricultural improvements and as such those that were already existing have been fostered and new ones as at Dumraon established.

Mr. Finucane the head of the department and the officers serving under him have been duly noticed by Sir Rivers Thompson for zealous effort in starting the Agricultural Department in Bengal and for efficient management of it since its establishment. Though handicapped for men and money, the Department has, during the short period of barely $1\frac{1}{2}$ years, amply justified its existence and given signs of its future usefulness.

TO THE EDITOR OF

The Indian Agricultural Gazette.

SIR,

Various proposals are afloat to associate the event of the Queen's Jubilee with others more lasting in their effects on the welfare of her Indian subjects. Of these, the inauguration of a scheme of technical education in India has been pronounced on all hands as the most deserving of such an honorable association. There can be hardly a more fitting testimony of our loyalty to our beloved sovereign than to associate the fiftieth year of her reign with the promulgation of a new line of education and thus make it a landmark in the educational history of India. Public feeling seems at this moment to be in an unusual ferment over the question of technical education; but a great deal of misconception hangs over the whole affair. Opinion is still divided as to the way by which it could be best and most easily attained. Those who look about themselves have long since ceased to look up to the Government and any lingering doubts they might have had have been dispelled once for all by Dr Hunter, when he said in lucid and unqualified language that what we were to expect in future was not increased State action but increased State help. In its present financial crisis the Government can not be reasonably expected to take an extra-burden on its shoulders in the shape of technical institutions; and even if they were financially better off it would argue a sheer want of

manly self reliance if we were to passively look on every great and worthy movement instituted by the Government without taking our due share in it. A time there was when we were under the tutelage of a paternal Government; but thanks to the education which we have received, we no longer like to be in leading strings, and have pride enough to imagine that we can think and act as well as any other. It is all very well to accuse the Government squandering away public money in Burma and on the frontier; such complaints have no doubt their own uses but when we feel certain that if we were to depend upon the Government for taking the initiative in the matter of technical education, we would have to wait till doomsday, why should we not take the lead ourselves and thus show the Government that we are not only alive to the necessities of the times, but also know how to meet them. We should remember that the causes which have made technical education an immediate necessity in India are purely social. We are indeed too often prone to accuse the University of demoralizing our youths by making them unfit for any thing else but the desk; but we forget that the bad odour which increasingly attaches every day to the University arises not so much out of any inherent unsoundness in it, but mainly out of the stagnant and morbid surroundings of the society amidst which it has so long worked. The social instincts of our educated youths are naturally opposed to all kinds of manual labour, and we would do well to liberate the society from such antiquated prejudices instead of casting uncharitable reflections on education which has been accepted in all times and places as an unqualified boon. We have all along zealously guarded our social and religious rights from being in any way tampered with by the Government. If we therefore once perceive that the distress which is so much felt among the educated classes of the community is social one in its origin, it is only meet that we should show the same determination to help ourselves in this social difficulty. We are all agreed that technical education is the solution of this difficulty. For its attainment all we want at this moment is organisation. With a good organisation, we should be able to get together as much money as we could possibly wish for the purpose. There are enough rich and liberal minded men among us who will be but too ready to countenance a movement so worthy of public support. I feel perfectly assured of the pecuniary side of the question but I entertain grave doubts as to our national power of organization. The spirit of political organization runs particularly high among us; but it is questionable whether we can put forth the same amount of resolution and *esprit de corps* in realizing an end so much desired for as technical education. Whether our powers are sufficient to grasp and successfully handle such an important problem, it is no reason why we should stand by in utter helplessness; on the other hand, having a noble cause which has enlisted universal sympathy on its behalf, let us make the best use of the opportunity by making it the means of testing our power of organisation.

Yours etc.

January 2, 1887. A Technicologist.

PRACTICAL SCIENTIFIC BREEDING OF GAME FOWLS.

There is hardly any subject upon which opinions more widely differ than upon the best methods to be pursued in the breeding of exhibition stock. This diversity of opinion is perhaps to be accounted for by the fact that well-known breeders have succeeded in producing the uniformity of excellence aimed at by apparently widely different methods. We say apparently different advisedly, and we trust that before we have concluded the subject our readers will agree with us that the difference is more apparent than real.

To inbreed or not to inbreed is the question which first presents itself, and when that has been decided there follow other questions of almost equal importance. We propose to discuss scientific breeding. The theory of breeding poultry and pigeons is similar to that observed by the breeders of larger stock, but in consequence of the difference of conditions existing as to length of life and similar matters, the practice is of necessity dissimilar.

We do not intend to go very deeply into the scientific question, but rather to deal with the matter practically. It is necessary, however, that we should, for the benefit of less experienced readers, begin by defining a few of the leading terms.

In the first place, then, what is '*Inbreeding?*' It consists [for our purpose] in the mating of birds which are related in blood to each other. The relationship may be the near, as that of a brother or sister, or remote, a mere fortieth cousinship, for instance; but if there be any relationship between the birds which are mated it is inbreeding.

'*Prepotency*' is another term which must be defined. It is the power possessed by a bird of stamping his or her likeness upon the progeny of a union to the exclusion of the likeness of the other parent.

Heredity' is the inheritance by offspring of the characteristics or likeness of their ancestors more or less remote.

A '*Strain*' is, properly speaking, a family with established and recognized points of mutual resemblance.

A '*Breed*' is generally understood to mean a natural division of species differing in certain distinct point from all other species. A breed may consist of several '*Varieties*' agreeing in certain common features but differing in others. Varieties are generally artificially produced, or they may be produced by different climatic or such like influences operating upon certain individuals of a breed. They may also be the result of a 'sport', which is an accident or freak of nature, whereby is produced offspring differing in some important point or points from the breed or variety to which its parent belonged.

Throw[illegible] is a return by the offspring to the original or natural type of the parents.

The theory of natural selection and the survival of the fittest, to which we shall have occasion to refer, put shortly is as follows; Birds, as other animals, in a state of nature select their mates partly on account of their superior strength, etc., and partly on account of certain beauties pleasing to the eye. In addition to this the weaklings of each brood die, and those the plumage of which is the least adapted for concealment from predatory animals, etc., fall prey to their natural enemies. In both these ways the strength of the stock is kept up, and a particular type of plumage (that most pleasing to the eye of the other sex or that most suited for concealment from enemies) is perpetuated.

Artificial selection is entirely different, and consists in the first instance in the arbitrary settling by men of certain features which he desires to perpetuate, and the perpetuation by artificial means of these features.

Having said so much by way of explanation we come to the first great question. Is inbreeding desirable? Much has been written on both sides of this question, and many statistics have been prepared by the advocates of each view. Into these we shall not go, but the concise result of the matter seems to us to be this.—Inbreeding is not of itself injurious. In theory you might inbreed for ever and do no harm, subject only to the proviso that the original pair chosen for the experiment were entirely free from any diseases or latent tendency to diseases. In practice this proviso is so difficult to fulfil that success in extreme inbreeding is the exception and not the rule. The importance in practice of this consideration of perfect health may be demonstrated thus: We take two birds, A and B, both apparently in perfect health. A is the bird of the exact type which we desire to perpetuate, and from whom we mean to inbreed. A has a latent tendency to say liver disease. B has no such tendency. From the offspring of the union of A and B we select the bird most suited to our purpose and mate it with A. This bird is half A and half B. The progeny of this latter union are three-quarters A, one-quarter B. One of these again is chosen and mated with A. The produce are seven-eighths A and only one-eight B. We have thus a number of birds partaking very strongly of all the tendencies of A, and having these intensified by the fact that they have only one-eighth of any other blood to counteract these tendencies. The tendency to liver disease has probably been developed by this into actual disease, and this is caused by the inbreeding. Had there been no inbreeding the young birds would only have had in them one-eighth of the blood of A and seven-eighths of various other letters of the alphabet, none of which probably had a tendency to liver disease. If both the original pair, A and B, happen to have tendencies towards the same disease the evil result will be arrived at all the more rapidly. It will be apparent, then, to our readers, that however harmless inbreeding may be in theory, in practice the probability of evil resulting is most material.

In the cases of poultry and pigeons pedigree breeding is much less usual than it is with horses, cattle and dogs. It is more difficult to identify the progeny of each pair of birds, especially with poultry, than is the case in regard to other stock referred to. No pedigree is required, and the most successful breeders are reticent in disclosing the methods adopted by them. It is thus almost impossible to adduce instances of successful in breeding of poultry or pigeons. At the same time it is known to many fanciers that in most classes the winning birds are the results of judicious inbreeding. We can, however, argue with certainty from the analogy of cattle. In the herd books of the owners of very best strains of Shorthorns will be found the record of how much inbreeding has done for this breed. It is by no means unusual to find that the name of the same sire appears five or six times in the pedigree of a Shorthorn, and in some cases inbreeding has been carried even further than this. It is true that in some instances these highly bred stock become barren, but this seems to us to be merely a development of a latent tendency in this direction which existed in the family. Be this as it may, the fact remains that the most successful breeders have resorted with no sparing hand to inbreeding.

We think it necessary to say this much in support of the method of breeding which we are about to recommend, because popular ideas are so much astray on the subject. It is perfectly common for beginners in purchasing stock to make a proviso that the birds sent shall be in no way related to

each other. Authors even in writting about poultry, discourse upon the necessity of avoiding inbreeding, and speak of it as if it were an unmixed evil. As an example of this we would refer our readers to the paragraph on this subject in the A B C Poultry Book,' and other instances might be easily cited.

This general craving for fresh blood is founded partly, no doubt, upon the commonly accepted theories as to inbreeding, and partly upon the indisputable fact that inbreeding sometimes produces evil results and may be carried too far. It is also founded upon ignorance of the actual state of facts as to the fancy poultry and pigeons. These are for the most part, as at present known, the results of artificial selection, and this artificial selection has been going on in the case of many breeds or varieties for a great number of years. The show bird of to-day in most breeds is of a very different type to its ancestors of some years back. The process of artificial selection has developted certain points which are known as the chief points of the breed. So long as the breeding stock is composed of birds of the same family—even though they be but distantly related to each other—these artificially created points continue to show themselves, and the more inbred the family as from birds perfect, or approaching perfection in any particular point, the more fixed does that become in the progeny. The moment, however, that entirely fresh or foreign blood is introduced the work of years is in all probability overthrown by the natural tendency, which we have already referred to, to throw back to the original type. It may be that in consequence of one or the other of the parents being very highly bred, and thus prepotent as to certain points, and the progeny, or a proportion of them, will be good in these points, and that the tendency to throw back may in this way be counteracted, but it will only be counteracted as regards the first generation; and the birds thus good in points, but what is known as loosely bred, will be worthless for the purpose of stamping their likeness upon their offspring.

We may illustrate our meaning by a reference to the Brahma fowl. The original Brahmas were of a mixed gray color, and the Lights and Darks of the present day are said to be descended from a common ancestry. The points in each variety have been developed by artificial selection. The exquisite pencilling of the hens is a salient feature of the Dark variety, which, perhaps more than any other feature, has been produced by artificial selection. If the best penciled hen that can be procured be mated with a bird of the highest quality, but perfectly unrelated to herself, it will be found that the penciling is at once lost, and that nearly if not all the pullets are of a mixed gray color quite wanting in penciling. It may be that a few of them, in consequence of the prepotency of the hen, show a certain amount of penciling, but for practical purposes the penciling as a family characteristic is lost. We may be met in reference to this statement by instances drawn from the experience of breeders in which apparently perfectly unrelated birds have produced well-pencilled progeny. As to this, we can only say that in these instances the parent birds were probably distantly related to each other. Most strains of Brahmas are more or less descended from a common stock in the first instance and have also at one time or another been crossed one with the other. In this way it is difficult to be certain that the parent birds are in reality unrelated to each other; and successful results attained with apparently unrelated birds are probably to be accounted for by the fact that a distant connection unknown to the breeder actually existed between the birds, or it may be that the good results are to be accounted for by the prepotency of one or both parents.

NEWS.

Prospects of Late Crops (paddy, cholum, ragi, cotton, castor and lamp oil-seeds and gingelly oil-seeds) in the Madras Presidency.

The forecast dealing with the sowings of the late crops is as follows:—The period embraced is from September to November. The area sown cannot be compared with that of the corresponding period of the preceding year, as the cultivation statements of the latter do not show the acreage of early and late crops separately. The area sown in each of the three months to which this report relates is shown below:

Months	Paddy.	Cholum	Ragi.	Cotton.	Gingelly oil-seeds	Castor and Lamp oil-seeds
	Acres.	Acres.	Acres.	Acres	Acres.	Acres.
September.	1,104,966	366,864	272,992	495,231	50,923	25,708
October .	902,593	401,171	155,300	229,331	22,510	66,591
November .	608,643	639,063	95,016	295,497	12,872	49,063

The following statement shows the percentage of the area under late crops to the total cultivation up to November 1886 ;—

Name of Crops.	Total area of cultivation up to November.		Acreage of late crops in 1886.	Percentage.
	1885.	1886.		
1	2	3	4	5
	Acres.	Acres.		
Paddy	4,467,995	4,959,156	2,616,202	52·7
Cholum	3,384 200	3,119 016	1,407,098	45·1
Ragi	1,243,406	1,178,575	523,308	44·4
Cotton	1,157,679	1,270,196	1,020,059	80·3
Gingelly oil-seeds ...	424,713	506,142	86,305	17·1
Castor and Lamp oil-seeds	544,080	642,152	241,359	37·6

"It will be observed that the extent cultivated with paddy, cholum, and ragi is nearly equally distributed between the two seasons. The oil-seeds are sown in the early part of the year, while cotton is planted in the latter part of the year. In the case of cholum and ragi, the area under cultivation during 1886 was below that of last year by 9 and 6 per cent., respectively. In case of the other crops, it exceeded that of last year—paddy 10 per cent. cotton 9 per cent., castor and lamp oil-seeds 15 per cent., and gingelly oil-seeds 16 per cent."

Prospects of the Cotton Crop in the North-Westerh Provinces and Oudh

The final forecast of the cotton crop of 1886 is as follows:—"*Area.*—The total area of the previous year (corrected by omission of 'manua' or 'radhia' cotton which flours in march) and the area under the present crop are shown division by division in the following table:—

Division.	Area under cotton in 1886. Pure.	Mixed.	Total.	Total area under cotton in 1885.	Total average area under 1875-85
Meerut	179 883	220,771	400 654	361 567	299,282
Agra	62 750	514 2·8	577 018	517,131	378.747
Allahabad	10 011	446,660	456.671	474 226	395 660
Jhansi	10,010	70,955	80,965	80.616	82 427
Tarai	2 470	3 836	6,306	2,297	5 900
Rohilkhand	45 463	181 376	226,839	181.739	179 392
Benares	5.668	13,866	19.534	14,811	17,959
Total North-Western provinces ...	316 255	1,451,782	1,767 987	1583,117	1 359,8··7
Lucknow	5 171	45,375	50,546	37 202	19,632
Sitapur	5 470	32,389	37,859	28,626	22.748
Fyzabad	717	496	1.213	8 693	9.083
Rae Bareli	1 520	1 997	3.517	2,509	2,416
Total Oudh ...	12,878	80,257	93,135	72 030	53 879
Total North-Western Provinces and Oudh	329,133	1 531,989	1,861 122	1,655,147	1,413,246

"The present area thus exceeds that of the previous year by 205,975 acres and the 'normal' area by 447,876 acres, or taking 100 to denote the normal area, the area of the present crop stands at 131. This large excess is chiefly due to the early setting in of the monsoons and the generally favourable season. The large excess over last year is in some measure due to the wholesale destruction by floods of large tracts of cotton in 1885. "*Condition.*—The information under this head has been obtained from the selected zamindars of districts. The avarage condition of the crop according to their bulletins is noted below:—

The Doab	70	Taking 100 to represent full average crop.
Bundelkhand	40	
Rohilkhand and Tarai ...	66	
Benares Division and Jaunpur	50	
Oudh	50	

"*Outturn.*—Adopting the standards of full outturn accepted last year and modifying them in proportion to the condition of the present crop, the total outturn of the 1886 crop would be 45,000 tons. If the local consumption be put at h of a lb per head of population which is believed to be very near the mark, the total quantity required for local consumption would be about 15,000 tons, leaving 30,000 tons for export. "*Stocks and trade.*—The total outturn estimated last year was 40 000 tons; the net export by rail from 1st October 1885 to 30th September 1886 amounted to 38,370 tons. Traffic by road was not registered during the year; in 1878 79 the imports from Rewah, Native Bundelkhand, Gwalior, Rajputana, and the neighbouring districts of the Punjab, amounted to 11,967 tons; the imports from Bundelkhand and Gwalior during 1885-86 have, according to the merchants of Cawnpore, been much larger, than in 1878-79. Taking the total imports by road 15 000 tons, the surplus left of the previous crop was a little over 1,600 tons:—

	Amount.	Total.
Outturn of 1886 crop ...	40,000	
Imports by road during 1885-86	15,000	
		55,000
Export by rail ditto ...	38,360	
Local consumption ...	15,000	
		53,370
Balance left in stock ...		1,630

Thus the stock of cotton in the United Provinces at the end of the harvest may be estimated at 45,630 tons."

Indian Wheat.

First General Memorandum on the Prospects of the Indian Wheat Crop of the Season 1886-87.—The Government of India propose to issue only three memoranda in future dealing with the wheat crop from time of sowing to time of reaping. The first memorandum which is now issued gives only a rough account of the state of the sowings; the second which will be published about the 15th March will afford as accurate information as may then be procurable regarding the area, condition, and outturn of the crop, and the third and final memorandum to be issued in the latter half of May will contain revised and fuller information on these points. The first reports for the season of 1886-87 have now been received, and the following particulars regarding the condition and prospects of the winter sowings of wheat are published for general information. In the Punjab the area placed under wheat is estimated at 6,857,000 acres or 2 per cent. below the area of last year. The October rains, which to a great extent regulate the earlier sowings, were confined to the districts near the hills, but during the last week of December a fair amount of rain fell generally throughout the Province and may perhaps result in an expansion of the area sown. The prospects of the crop at present is on the whole favourable, though more rain is reported to be needed in the Ambala, Ferozepore, Sialkot, and Peshawar Districts. In the North-Western Provinces and Oudh the prospects up to the 30th November were very fair and the sowings were coming up excellently except in places where it had rained immediately after the seeds had been put down. Later reports show that the fields are being irrigated and they confirm the promise of a good crop. The area sown at the end of November was estimated in December to be about 4 per cent. in excess of last year's area (5,240,300 acres). The prospects of the wheat crop in the Central Provinces at the end of December were very promising, especially in the Northern Districts, but some damage may have been caused by recent cloudy weather. In four districts an increase in the area under wheat is expected owing to the favourable rainfall before the sowings began. In Chhattisgarh also more land has been taken up for the *rabi* owing to the failure of the *kharif*.

In the Bombay Presidency the season at the end of November was reported to be very favourable for wheat, and at that date the area sown was estimated to be, if anything, larger than the average in all parts of the Presidency. In the early part of December there was some heavy rain in the Deccan and parts of the Karnatak, but no actual damage to sowings was reported. Later information shows that at the end of December the young crops were coming up well and that prospects were good. In Berar the area under wheat in the latter part of December was above the average, which is 807,000 acres. The crops were a foot high and generally in excellent condition, and there is every promise of a good average yield. In Central India, Rajputana, Hyderabad, and Mysore, the prospects and condition of the wheat crop, so far as can be gathered at present, are also favourable. The general condition of other food-grains and non-edible crops sown at this season appears to be good, and there is no reason at present to [illegible] any diminution in the proportion of the wheat harvest available for exportation. The supposed normal wheat area of each Province is quoted below:—

	Acres
Punjab	7,000 000
North-Western Provinces and Oudh ...	5,037,000
Central Provinces	4,000 000
Bombay (including Baroda)	1,883,000*
Berar	803,000
Bengal (Behar)	850,000
Rajputana	2 500,000
Central India	2,500,000
Hyderabad	750,000
Mysore	20,000
Kashmir	500,000
Total	25,843,000

Prospects of the Burma Rice Crop.

The report to 31st December 1886 is as follows:—"The total area under rice cultivation in the ten surplus rice districts is now (31st December 1886) reported as 3,324,520 acres, or 3,635 acres less than last month's estimate. The estimate of the outturn reported last month is maintained except in Tharrawaddy, Prome and Bassein, in each of which it is slightly raised. There is said to be a slight scarcity of labour in Bassein. No complaints from other districts and no interruption so far, of harvest operations by any disturbances. Harvest generally well advanced and nearly completed in six districts. The estimated exportable surplus remains 1,100,000 tons."

* Inclusive of Baroda, but exclusive of the other Native States under the Political control of the Government of Bombay.

Prospects of the Wheat Crop in the Central Provinces.

The first report is as follows:—"The rain, which fell in September and October, was generally favourable for sowings, although it was too heavy and continuous in some districts, and sowings were somewhat retarded. Prospects on this date are very favourable, especially in the Northern districts; but the recent cloudy weather, should it continue, is likely to damage the crops. In Nimar, Betul, Balaghat, and Bilaspur an increase in the area sown may be expected owing to the favourable rainfall before sowing time, and also to the failure of the *kharif* crops in Chhattisgarh, where, in consequence, more land has been taken up for *rabi* crops.

Prospect of the Wheat Crop in the Punjab

The first report is as follows:—"Estimated area under wheat this year 6,857,000 acres, or 2 per cent. less than last year. Rain fell in October only in the districts near the hills. In most other districts the sowings are short."

Prospects of the Oil-seed Crops of the Punjab

The report for December is as follows:—"Estimated area under rape seeds in 21 selected districts 511,000 or 8 per cent. less than last year. Reduced area owing to deficient rain."

Returns of Railway-borne Traffic of the Central Provinces for the Quarter ending 30th September 1886.—The total Traffic of the quarter amounted to rather more than 28¼ lakhs maunds and was only about one-third of that of the previous quarter. This was however nothing unusual as trade in these Provinces always declines very greatly during the rains, owing to the long distances over which produce has to be carried in some districts before it can reach the Railway. This is especially the case in the Chhattisgarh Division where the exports amounted to only 125,737 maunds against 10,54,851 in the preceeding quarter. When compared with the corresponding quarter of 1885, the returns show a small decrease of 82,000 maunds. The decrease was distributed over all the Provincial blocks except Nimar and Nagpur which show an increase of traffic. *Imports.*—The total import traffic shows an increase of 134,550 maunds over that of the corresponding quarter of 1885. There was an increase in the imports into all blocks except Chhattisgarh. The increase was due (1) to an increase of 53,139 maunds in the amount of salt imported, and (2) to the development of a traffic in juari between the Berars and stations in the Nagpur block. During the quarter under report, the Nagpur block imported 73,188 maunds of juari from places in the Berars and Khandesh whereas in the corresponding quarter of 1885, it had only imported 1,847 maunds. The increase was due to the apprehensions of the failure of the rice crop in the Bhandara and Balaghat districts, which were entertained in September, but which ceased (together with the import of juari) on the occurrence of a plentiful fall of rain in the following month. It should be added that the condition of the rice crop of Raipur and Bilaspur was much worse than that of the crop in Bhandara and Balaghat, but this had no effect in stimulating import into Chhattisgarh. *Exports*—The exports during the quarter were less by 2,17,182 maunds or by 10 per cent. and the decrease fell principally under the following heads:—Wheat, Rice, Gram and Linseed. Rice and Gram thus show the greatest percentage of decrease. The falling off in the exports of rice occurred mainly in the Nagpur Division, while the trade in Chhattisgarh remained nearly stationary. The decrease under gram occurred in the Jabalpur and Narbada blocks. There was on the other hand an increase under the following articles:—Cotton, Juari and Bajra, Hides and Skins, Til. The cotton was sent from the Narbada and Nagpur Divisions to Bombay Port and places in the Bombay Presidency, and the til-seed to Bombay from all Divisions, but principally from Nagpur.

External land trade of the Punjab, for the year 1885-86.—The following table shows the total foreign trade of the Punjab for the last five years:—

Year.	Maunds.	Logs.	Value, Rs.
1881-82 ...	1,929,706	34,590	2,31,18,093
1882-83 ...	1,730,603	52,965	2,06 50,866
1883-84 ...	2 107 046	42,315	1,90 51,568
1884-85 ...	2,120,427	82,505	1,88 75 840
1885-86 ...	2,220,887	51,632	1,94,63,862

There was again an increase in the weight of the total traffic, which exceeded that of the previous year by 100,000 maunds. The value of the traffic of 1885-86 was also greater than that of the traffic of either of the two preceding years. Imports show a slight falling off, but there has been a very considerable increase in exports. The most remarkable increases were in the import of logs and bullion from Kashmir, ghi from Kashmir, Kabul and Sewestan, and raw silk from Kabul and Ladakh; and in the export of Indian cotton piece-goods and Kohat salt to Kabul, and wheat to Kabul and Sewestan. There was, on the other hand, a considerable decrease in the import of madder from

Kabul, timber (not logs) and shawls from Kashmir, and fruits from Kashmir, Kabul and Sewestan The trade with each country has been noticed in detail below. It will be seen that the trade with Kashmir has somewhat fallen off, while there has been a revival of the Kabul and Sewestan trade. Kashmir maintains its supremacy in the import trade. while Kabul is still the principal market for exports. The trade with Chinese Tibet is registered at Wangto on the Sutlej. The import trade in raw wool and pasham which had to some extent fallen off since 1881-82 has again revived. Of the amount imported 2,059 maunds valued at Rs. 32,944 were recorded as wool, and 1,148 maunds, valued at Rs. 1,49,240. as pashm. Imports of borax again fell off. A statement which has been furnished by the Deputy Commissioner shows that the total remittances of silver coin received in the Simla Treasury from other Treasuries during the year under report exceeded twenty-three lakhs of rupees, exclusive of remittances in notes. Part of this silver no doubt finds its way to the plains and a small part is probably melted down and made into ornaments or hoarded by peasants in the neighbouring hills. But there can be no doubt that a considerable proportion is taken away across the frontier by merchants in payment of the wool and pashm brought in, and by the coolies who crowd into Simla during the hot season. Being of comparatively small bulk it generally escapes registration, and consequently we find the imports greatly exceeding the registered exports. Mr. Baber, in his report on the Chinese tea trade with Tibet, notices the great influx of Indian rupees into Tibet, which, he says, are now the common currency of that country.

Trade with Ladak—There has been a general improvement in most of the chief articles of trade with the exception of borax and charas among imports, and indigo and foreign tea among exports. Mr. Johnstone, the Assistant Commissioner of Kulu, reports that the increase in both imports and exports is mainly due to the fact that the Rotang and Bara Lacha Passes remained open in 1885 for a longer period than usual. Imports of raw silk and of raw wool and pashm have been steadily increasing. The Assistant Commissioner connects the increase in the import of these commodities with the decrease in the import of charas. He says that the Indian markets were overstocked with the large imports of charas in the previous year, and that the trades in Yarkand and Ladakh, finding it useless to import charas, laid out their capital in silk, wool and pashm. The regular importation of sapphires is said to have altogether ceased. If any are imported, the fact is concealed by the traders. The export trade in European piece-goods is steadily improving. Exports of indigo were very much greater in 1884-85 than they had been in any previous year, and the market is said to have been overstocked. The amount exported in the year under report, though far below the exports of 1884-85, was somewhat greater than the amount exported in 1883-84. Exports of Indian tea have increased to a greater extent as in previous years "gola chah," a mixture of China tea and rice-water, was shown partly as Indian tea, and partly as foreign tea. It has now been shown as foreign tea. The Assistant Commissioner makes the following remarks on the tea trade:—sidering the enormously increased export in 1884-85, I think the fact of another, if much smaller, increase in the export of country tea is very remarkable and looks well for the future. The price has gone down Rs. 8 per maund, doubtless because the quality sent up was poorer. As I pointed out in a supplementary note to my Trade Report of last year. the reason for the rise in average value of Indian tea exported by this route in 1884-85 was that the tea market below being very dull indeed during the first part of that year, better tea than usual was available for Central Asia. In 1885-86 the Indian tea trade improved and the quality of the tea sent to Central Asia was reduced, though the quantity was not. 'Gola chah,' a cheap and filthy compound of China tea and rice-water, has apparently held its ground in Tibet, to which country alone it is exported, for we have to record a rise from 196 to 229 in maunds and from Rs. 5,479 to Rs. 5,956 in value. But it is pleasing to note a diminution in rate per maund of nearly Rs. 2, which seems to show that increased export cannot now take place without a decrease in price, a state of affairs which will soon develop into a declining, or at the best, stationary trade. In Foreign tea we find a large decrease in export—from 302 maunds, value Rs. 45,300, to 181 maunds, value Rs. 25,400, the price per maund having fallen from Rs. 150 to Rs. 140. On the whole country tea seems to have the best chance for the future."

Trade with Kashmir.—In imports there was a slight decrease during the year under report as compared with the year 1884-85. In exports there was a decrease in value together with an increase in weight. The figures for 1885-86 are, however, higher than those for any of the three years preceding 1884-85. The following are some of the chief

headings for the past 3 years:—*Imports*—Drugs and Medicines (not intoxicating), Charas, other dyes, fruits (other kinds), Rice (husked), hides of cattle, leather (unmanufactured), ghi, raw silk, wood (logs No. other timber), woollens (native manufacture), shawls, specie and bullion. *Exports*—cotton piece-goods (European and Indian) brass and copper, iron, lahori salt, sugar (refined and unrefined) Indian tea. The export trade remained fairly steady, but the import trade showed extraordinary fluctuations. Of these the most noticeable are the decrease in the import of other dyes and shawls, and the increase in the import of woollen piece-goods and specie and bullion. During the illness of the late Maharaja it is said that the levy of customs duties on exports from Kashmir was suspended from religious motives. This may have had some effect in increasing the import of woollen piece goods into India. The falling off in the import of shawls is attributed by the Deputy Commissioner of Sialkot to the fact that the late Maharaja took a considerable personal interest in the shawl trade and used to send large quantities of shawls direct to his own warehouse in Calcutta for export to Europe. During his illness the business was not attended to. An importation of two maunds weight of manuscript Korans, valued at Rs. 4,000, reported by the Deputy Commissioner of Rawalpindi in November last, is worth noticing.

Trade with Bajaur—There was a slight falling off in imports both in weight and value, and a decrease in the weight of exports with an increase in their value. The decrease was entirely on the Hazara side, and is attributed by the Deputy Commissioner of Hazara to the blockade of the Kohistanis. There was a considerable development in the export trade in European piece-goods, with a slight falling off in exports of Indian piece-goods.

Trade with Kabul—The import trade with Kabul remained fairly steady during the year under report, there being a slight decrease of only Rs. 20,000. There was a very considerable improvement in the export trade both in weight and value. During the war there was a revival of the export trade, but this was no doubt caused by the presence of our troops in Afghanistan whose wants had to be supplied from India. With this exception, there has been a gradual decrease in the apparent value of Kabul trade during the last eleven years. The Financial Commissioner is not, however, prepared to admit that the trade has really suffered to the extent that these figures seem to imply. It is, after all, the export trade which is our chief concern and the exports of 1885-86 on the whole compare not unfavourably with those of 1875-76. In that year the figures were swollen by the high tariff values assigned, the European cotton piece-goods exported from Dera Ismail Khan in 1875-76 having been valued at no less than Rs. 412 per maund. The principal exports in 1875-76 were, as now, piece-goods, tea, and indigo. The weight and value of the exports of these commodities and of the total exports to Kabul in the two years are compared below :—

	1875-76.*		1885-86.	
	Maunds.	rupees.	Maunds.	rupees.
cotton piece-goods (European)	12,025	32,82,360	17,863	18,29,100
cotton piece-goods (Indian)	34,549	11,51,346	28,128	13,30,907
Indigo	8,180	5,96,492	4,000	2,85,609
Tea	12,970	18,52,441	16,867	11,81,582
Total exports ...	264,830	81,66,555	3,17,769	53,63,909

There is no reason to suppose that the quality of European cotton piece-goods and tea has deteriorated within the last ten years, and the Financial Commissioner considers that he is justified in concluding that, if exports were valued now at the same tariff rates as they were ten years ago, the apparent decrease in the value of the export trade would be converted into a small increase.

The returns of the import trade of Kabul are not so encouraging. In 1875-76 the principal imports were charas, "other drugs," dyes (principally madder), silk, fruits and nuts, and wood. The following table compares the imports of these articles and the total imports for the same two years:—

	1875-76		1885-86	
	Maunds.	rupees	maunds	rupees
charas	2,136	8,62,960	576	62,470
"Other Drugs" ...	8,054	6,21,238	6,950	94,851
Dyes	90,457	14,20,330	39,541	4,98,972
raw silk	3,542	19,06,210	1,046	3,42,530
Fruits and nuts ...	129,280	17,80,088	78,095	6,76,299
Wood	539,494	12,79,935	14,704	9,709
Total imports ...	888,382	91,43,712	2,00,764	23,24,082

Here again under every single head the tariff values of 1875-76 are higher than in 1885-86. The import of wood also, which accounts for 60 per cent. of the maundage of the former year, was abnormal, the wood having been sent down by the express order of the Amir of Kabul to be sold for the use of the Punjab Northern State Railway. The import trade has, however, to a considerable extent deserted Kabul. We now get charas from Yarkand and Kashmir; silk from Kashmir and Ladakh; fruits and nuts from Kashmir; and wood

from Kashmir, from our own forests, and from Chamba; while the decrease in the import of madder would seem to show that this dye is to some extent being supplanted by aniline dyes. Imports of madder depend to a great extent on the character of the crop in Khorassan, where it is grown. In 1884-85 the import of madder was stimulated by the failure of the crop in 1883-84, and the imports for 1885-86 are, in consequence, considerably smaller than those for the previous year. The decrease in imports of fruits and nuts was due to the injury caused by severe hailstorms in the spring of 1885. It is satisfactory to notice that the import trade in raw silk has somewhat improved. Exports of European cotton piece-goods have increased considerably, while exports of Indian cotton goods have increased by nearly 50 per cent. A reference to the figures of 1875-76 given in the preceding paragraph will show that a preference for European manufactures is steadily growing in the Kabul market. Exports of wheat, Kohat salt, and manufactured leather show an increase, while there was a large decrease in exports of sugar. The trade in India tea seems to have revived, the exports being nearly as high as in 1883-84. There was a further decline in the export of foreign tea.

Trade with Tirah is registered in the districts of Peshawar and Kohat. There was a considerable increase in imports into Peshawar, chiefly under the heads of reeds, matting, firewood and charcoal. Among imports into Kohat, there was an increase under the heads of ghi, firewood, dwarf palm-leaves, and timber. Imports of fruit show a decrease, due to the destruction of fruit by hailstorms in the spring of 1885. The decrease in the export of Kohat salt is said to be due to the abnormally large exports of this commodity in the preceding year.

Trade with Sewestan—During the year under report there has been a very considerable increase both in imports and exports, occurring chiefly under the head of cotton piece-goods and wheat among the latter, and of specie and bullion among the former. There was a decrease in imports of fruits and wool. The following explanation of the large importation of specie and bullion is given by the Deputy Commissioner of Dera Ghazi Khan:—"In imports the increases noted are small, not calling for comment, with the exception of the item of Rs. 41,600 under head "gold and silver." In consequence of the Zhob valley expedition, the Pathans of those parts lost large numbers of sheep and goats and heads of cattle. After the expedition, when the country was again in a settled state, the demand rose for cattle, and Pathan dealers came into this districts with large sums of money and purchased many thousands of head, also other articles of merchandize, particularly piece-goods (*sic*). During the months of February and March the road leading through Fort Munro to the Khetran valley used to be choked up with great herds of cattle and sheep and goats, all purchased for sale in the Zhob Valley and adjoining Pathan countries." The Deputy Commissioner attributes the decrease in the import of raw wool to the loss of sheep and goats referred to in the above quotation.

FAIR TRADE.

BY A PLOUGHBOY.

Now how is it that there is no labour for the poor man? Why, because it is done abroad. We find that every quarter of corn grown in this country costs about 4s. for manual labour. Well, every quarter that comes from abroad does away with that labour. Again, there is the flour, that does away with our offal that we should have to feed with if the wheat were ground in this country. Then there are all other goods, such as door-frames, window-frames, and all sorts of goods made abroad, must do away with our labour, so that it is not to be wondered at that there are so many out of employ. As a poor man said the other day, what is the good of a loaf of bread for 4d., when you have only 2d. to buy it with. We don't want a dear loaf, but we want all agricultural produce, so that master man can live. Where does the money come from but the soil? And if we make but little of our produce there is but little for the labourer, and all the cattle that comes to this country does away with our cattle-men, and in fact, if the produce makes no money, there is none to spend. The landlord gets but little rent, therefore he has not so much to spend; the farmer gets but little for his produce, so he cannot pay heavy labour bills, which every sensible farmer would be only too pleased to pay because labour means profit if properly done, and the produce made the profit.

Well, what is the reason farming don't pay? Because the foreigner has our money, instead of keeping it at home. But we will not lay all the blame on them for the land is taxed to death with tithes, rates, &c. How many hundred years have we done without Local Boards, School Boards, and almost without unions? What do the unions do? Why, encourage a lot of lazy scamps that will not work, but travel from one house to another.

What has the law done by placing all the parish business in the hands of auditors? Why, it has taken away all the power from the ratepayers which they used to have. When they met once a year and audited all the parish accounts themselves they could see how their money was laid out, without spending £3 or £4 for audit stamps. How does a man know if all the entries are correct in the book's, if he does not set a foot in the parish? neither does he care, so long as the books balance. And again, why are the foreigners allowed to send their produce into this country, wearing out our roads, not paying a penny towards the repairs. I don't consider we have any power over our little money; for law sets inspectors to watch after the public as close as a cat after a mouse, and what do they know? When they go in to see a herd of cattle, do they know their heads from their tails. That is as much as they do, many of them; but that means taxes and pay. And why do we get disease in our pigs so often of late years? I believe it is the foreign corn that gets heated in the ships, as I am told that they are lined with copper; and if so, and the corn gets heated, it is quite reasonable that this will kill cattle. I have hundreds of pigs from their mothers yearly, but never had any complaint, nor never use a bit of foreign corn; and I am surprised to hear our neighbouring farmers grumble about the foreigner, and at the same time selling their own corn at a few shillings more per quarter, and buying foreign, which, if properly cleaned, would be dearer than their own. I never use foreign cake nor corn, so that if all were like me they would have to keep their stuff at home. The millers cannot make flour out of English wheat! What should we do if war was to stop the foreign? Should we starve? Nay, but have some of that good old sort of wholesome bread, like we had in old times. Not a pennyworth of bread and a pennyworth of beer to get in down—another trap on the public. The bakers have to give their 4 lb. for a loaf of bread, so they take good care to under-bake it, so that it weighs well. Where is the family baker of that good old home-made loaf? Oh, our daughters don't know how to bake now-a-days! But we must not touch the ladies too much; so we will see what taking off the malt duty has done. Why, it has filled the country with foreign barley and malt, and ruined the farmer's barley trade in this country. Then, should not the foreighner pay 10s. duty for the malt sent into this country to help pay the repairs of the roads and help the labouring man who has to lose his labour. All this has not lowered the poor man's beer. As I have said, all foreign goods wear our roads and do away with our labour. Where is our Government that they don't see to it, and protect our own country? Every manufactured article ought to pay duty that comes from abroad as much as the labour would cost here.

What does away with so much labour as the butterine. I am glad I thought of that. I had almost forgotten that disgraceful stuff, and that we cannot tell what is sold as butter. Butterine! as a grocer said to me the other day, and laughed: "This beats you, old friend; five pence per pound, and we make a shilling of it." And a dealer one day told me he had bought plenty of it, and rolled it up and sold it for fresh butter. Sometimes we get found fault with in our butter; but I do not know who knows the proper taste of butter now, for there are so many sorts, and all about the same price, good or bad. I am told the clubs use the butterine; if so, who can wonder at the labourer starving? Does anyone know how much it costs for labour to make one cwt. of pure butter? Yes, about £1 10s. for labour, on the average. Then every cwt. of butterine takes that from our labour. Why should that be allowed to be sold without a heavy duty to make up for some of this loss? Men now talk about dairy schools and training dairymaids! Why, no one will be wanted soon. But all these factories and colleges and new fashioned dairies do not beat the old plan that every farmer should keep a good dairy, and have his wife for head diarymaid, and then his butter is sure to be good. These few simple remarks may amuse some of your readers if this is worh a space in your paper. Better times coming.—*Agricultural Gazette* (*London.*)

THE INDIAN SILK INDUSTRY.

II.—Mulberry Trees.

The mulberry tree grows rapidly in almost all the soils of warm climates. It requires a copious supply of water in all seasons except during the two winter months, when its leaves are shed. In summer it requires heavy watering at least once a week. With heat and water the strength and productiveness of the plant are speedily developed. The care of the seed plot is the most delicate point in mulberry culture. It can be successful only under certain conditions which I shall attempt to enumerate briefly. The heat of the sun is the great obstacle when sowings are made in June. If the fruit is gathered, it is necessary to separate the seed from the pulp in order to secure regularity in the sowing. If it is desired to sow thinly so as to obtain robust plants the very first year, the seed may be mixed with sand and, care should be taken that it is sown in ground

specially prepared and protected from the burning rays of the sun; under trees, for instance, or else covered with long straw. As the soil must be kept constantly moist, it should be watered every evening with watering pot. In 12 to 15 days the seed germinates, and must be treated in the same manner as before till the two first leaves have been fully formed, when the straw covering should be taken off, and the seedlings watered copiously, without using the water pot. In autumn the plants grow rapidly, attaining the thickness of a pen holder and a height of from 40 to 80 centimetres, according to the surrounding space. When the seedplots have succeeded they are weeded and thinned by pinching off all superfluous plants.

Whatever be the ground, it must be dug to the depth of from 40 to 50 centimetres as early as possible. It must then be levelled and divided into beds of one metre in width. Between two beds there should be a foot-path from 30 to 40 centimetres wide to facilitate watering, weeding, &c. The seed should be sown broadcast in pinches, without fear of sowing too much. When autumn comes and the leaves are fully formed, the seed plots should be carefully examined, and when the ground is thoroughly soaked with water all weakly plants, or plants with small or deeply incised leaves, must be pulled up. These plants could but have given miserable leaves compared with others. I cannot repeat too often that the seed plot requires the greatest care, but once the plants are up, if only of the thickness of a thread, the mulberry tree gains strength very easily. To avoid the rays of the sun of June and July, it would be preferable to make the sowings in the spring, in March for instance. It would be sufficient to provide oneself with good seeds of the white mulberry. Sowing in spring has the great advantage that you can from March to June get through a series of sowings, undertaking a second when the first has germinated, and thus with a small staff obtaining a large number of plants. In summing up the different sowings, one should obtain 10,000 plants to the "are" (119½ square yards). The soil of the seed plots, being well-prepared, need not be dug up again. The number of plants will not permit it, and it will be sufficient to weed and water the ground well.

When the seedlings have shed their leaves and the bare stems remain in mid-winter, they can, after a profuse watering, be pulled up by handfuls. The stronger ones only should be selected; the weaker should be left to develop further. Previously to this the ground should have been prepared according to the recognised rules of cultivation, and laid out in ridges more or less apart accordingly as you require a quicker or slower development. The small plants pulled up, as just explained, are then planted in rows on the side of the ridges. Immediately after planting they are cut down level with the ground, and if during the year care has been taken to destroy the lateral shoots, the result will be a growth of from two to three metres in height. You can also make from the plants of seed plots, hedges, trimmed mulberry trees, etc. When one plants in cropses, the plants should be as close as possible, to obtain a prompt supply of leaves. The plants in rows are about 150 to two metres apart. The best pruning is that about one metre from the ground. In three years you can rely on obtaining from 25 to 30 seers of leaves from each tree and at least 100 seers in five or six years. I would advise pruning in the shape of a crown on three branches, and the year following on two of each of the three branches, which would make six branches, and so on up to a complete formation of the form of a salad bowl. The tree at its 10th or 15th year will have a trunk of form 30 or 45 centimetres in diameter, and its value may be estimated at from 15 to 20 francs per tree. If by pruning intelligently and according to the requirements of the country a form is given to the trees which is appreciated, their value may be much higher. The *multicaulis* variety of the mulberry yields a sure income.

Its cuttings are easily made and take root at all seasons. It throws out its new leaves 20 days before other varieties, and sheds them 20 days later. You can plant 20 per square metre. If you do not wish to preserve them you can graft on them during the ensuing spring and obtain in the course of the year a growth which would have needed three years if raised from seed. You might also cut off a branch, graft it, and place the graft in the soil as an ordinary cuting. The very first year a plant will be secured of 0·80 to 1·50 centimetres in height. The *multicaulis* variety should be cut level with the ground when cultivated for its leaves. In every case one learns by practice, for in this country practice should always take precedence of theory. If you follow to the letter what is recommended for Europe, you will not attain the desired results so soon. Plantations of white mulberry trees on the border of streams, roads, or fields would be of great benefit to silk culture.

In no case would the plantations injure the crops of wheat, rice, etc. On the contrary, they would restore to agriculture rich and large tracts which are now lost owing to the native system of sowing, and even yield the value of their ground rent owing to the inferior quality of the leaves which often prove insufficient to feed silkworms properly till their spinning stage, a fact which I have frequently witnessed. With such plantations, the abundance

and the nutritive and silk producing quality of the leaf would make it easy to obtain a large crop of European silk worms annually, and a second one in autumn, which would show a profit five times more renumerative than three or four miserable crops of country cocoons. The regular hatching of the silk-worm eggs can always be easily secured by preserving them for three months in an ice house arranged for this purpose, the cost and keep of which would be trifling. The eggs, after a hibernation of three months, can be hatched as easily as animal eggs.

By the last mail per the Tibre I received a sample box of silk-worm eggs of yellow and white cocoons, of which the greater part has been given to persons in the mufassal who are interested in the trade. Should, however, anyone wish to make experiments in cellular reproduction for the next new crop with these eggs, I can still give some samples for trial

G. GAUTHIER.—*The Englishman.*

CROP AND WEATHER REPORTS.

For the week ending 5th January 1887.

General Remarks.—Except in the North-Western Provinces and Oudh, the Punjab, Rajputana and Assam, where there were slight showers in a few places, the week under report has been rainless

The kharif harvest still proceeds in Bombay and Berar, but in all other parts of the country it has been completed. In Madras the paddy crop is being cut with generally an average outturn. In Mysore and Coorg the standing crops continue in good condition

The rice harvest is approaching completion in Bengal, Assam and Burma, and good outturns are expected. In the Central Provinces the crop is being threshed, and in Bombay and Coorg the crop is being harvested.

In Bombay and Berar cotton-picking in the progress. The prospects of the poppy crop continue generally favourable the Bengal a d the North-Western Provinces and Oudh.

The prospects of rabi crop are generally very favourable throughout the country, though in the Punjab and the North-Western Provinces and Oudh more rain would be beneficial.

The public health is good in all Provinces.

Prices are Generally stationary everywhere, except in the Punjab where they are rising in four districts.

For the week ending 12th January 1887.

General Remarks.—With the exception of Madras, Mysore and Coorg, Bombay and Burma slight showers have fallen in most places

The kharif harvest has been brought to a close in all parts of the country, except Bombay, and the rabi sowings which have been completed everywhere are coming up well Prospects of the harvest are generally very favourable. In parts of Bombay and the Central Provinces, blight and hail have damaged the crops, but not seriously

In Madras the standing crops are doing well, and the harvest in progress continues to give an average yield In Mysore the season promizes favourably

The rice harvest is almost over in Bengal and Assam and is well advanced in Lower Burma In Bengal there has been a good general outturn

Poppy has been affected by cloudy weather and caterpillars in parts of Bengal, but in the North-Western Provinces and Oudh the crop is flourishing

The public health continues generally satisfactory

Prices are rising in four districts of the Punjab, showing an upward tendency in the North-Western Provinces and Oudh fluctuating in Mysore, and falling in Coorg Elsewhere they remain generally stationary

For the week ending 19th January 1887.

General Remarks.—Rain has fallen generally throughout the N.-W. Provinces and Oudh, Punjab, the Central Provinces and Central India and Rajputana. In parts of Bengal and in Assam and Sind slight showers have also occurred.

Except in Sind the kharif harvest has come to a close in all parts of the country, and threshing operation are in progress. The recent rainfall has been of considerable benefit to the rabi, which is generally in excellent condition throughout the country. In the northern districts of the Central Provinces also some damage to the crops is apprehended in consequence of the late heavy rain.

In Madras the paddy harvest still continues and general prospects are good. In Mysore and coorg the outlook is favourable.

The rice harvest in Bengal is nearly finished with a good outturn, and in Lower Burma the reping of the crop is will advanced.

Poppy continues to come up well in the N.-W. Provinces and Oudh, but in Bengal the crop has been injured in places by rain.

The coffee harvest is in progress in Coorg.

The public health is generally good in all provinces

Prices are rising in four and fluctuating in two districts of the Punjab and are falling in Coorg. Elsewhere they remain generally steady.

For the week ending 26th January, 1887.

General remarks.—rain has fallen in Bengal, the northwestern provinces and Oudh, and Assam. Slight showers have also occurred in the Punjab, Central Provinces, Central India, and rajputana.

Except in Bombay and the Central Provinces, where slight injury has been caused by blight rain, and hail, the rabi crops throughout the country generally are in good condition and have benefited by the late rainfall.

In Madras the general prospects are favourable, though rain is needed in Madura, Chingleput and Coimbatore The rice harvest in Bengal has been completed and the outturn is satisfactory.

In Burma the harvest is will advanced.

Poppy containues to thrive in the north-Westein Provinces, but in places in bengal the plant has been injured by rain and capterpillars.

Coffee-picking in Coorg containues and season is favourable.

The public health is generally fair. Fever and smallpox prevail in certain districts of the Bombay and Madras Presidencies.

Prices are fluctuating in two and rising in three districts of the Punjab, and are rising in three States in the Rajputana Agency; in Mysore they have fallen in two districts; elsewhere they remain generally stationary.

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Cawnpore Experimental Station.—The question of the improvement of Indian Agriculture as far as can be seen at present mainly hinges upon the introduction of cheap and easily available manures, and the attention of all interested in the improvement should be chiefly directed towards securing this object. The experimental stations all over India under different local Governments should confer a great benefit on the Indian ryots if by their joint efforts they succeed in proving the efficiency of and bringing into use some such manures for the adoption of our peasants. The Cawnpore Experimental Station which is one of the longest standing in India has, in its report of the Rabi season of 1885-86, come to the conclusion that, after all, farm-yard manure is, the cheapest and most efficient that the cultivators of the country can have; it never fails to ensure a good return and is always available. This is exactly in accordance with the experience of our Indian peasants, though the experimental stations in Bombay and other parts of India have not yet come to any definite conclusions on its efficacy. We are very often told that our peasants burn away their dung as fuel and thus deprive their lands through sheer ignorance of one of the best, cheapest and most easily available manures. But our experience has been different; they do burn it for fuel, no doubt, where fuel is scarce, but, if they can help it, are scrupulously averse to wasting it and carefully preserve every bit if it for use as manure. We know that in the Burdwan Division where our experience is principally confined, the peasants, when harvest time is over, go with their pack bullocks from village to village in search of farm-yard manure, which they buy at so much per load and pack away as best as they can. The peasants, farming on the heavy calcareous clay lands peculiar to west Burdwan on the right side of the Damudar, a little way from the immediate river side, are the buyers and the people residing on the raised sandy loam on the immediate river border are the sellers. The crop for which dung is exclusively used in the clay lands is paddy. But to return to the experimental station. The experiments also show conclusively saltpetre to be excellent manure, but the excise acts as a great damper towards its general adoption by our ryots. "Were there no salt excise," says the Director of the Agricultural Department, "I verily believe that saltpetre would come to be more extensively used, and with great advantage by the people. The dread of the *"permit"* authorities is deep-seated and it will be hard to rid the people of it. If by any means the simple manufacture of crude saltpetre could be allowed to spread. the way could be opened for introduction of this fertilizer."

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Detail of rotation and manure results:—One very important lesson that can be learnt from the results of the experiments in the farm is that for good and high farming rotation is indispensable. It has also been found that, although a fair crop of wheat can be got year after year from a land with the aid of artificial fertilizers, it cannot keep its fertility up to the point that the land kept under the rotation of crops keeps. In majority of cases the plots alternated with wheat and maize have given better yield than the plots in which wheat was sown successively. By the light of the theory which on the farm

has now proved true beyond doubt, it can safely be affirmed that for good cropping rotation is as necessary as manure. The experiments also teach that cowdung is the most handy and cheap manure for common peasants. By its application alone the percentage of grain over straw was not good but the weight of grain per bushel was very fair against unmanured plots in the series; it nearly doubled the yield. Applied with bone-dust, dung gave still better result. Similarly dung with gypsum has in many cases proved to be better than dung alone. In both the latter cases the percentage of grain over straw has been very good, being 78 and 80 respectively. Ashes of dung have never proved to be a good fertilizer, at all events never so good as the unburnt dung. The percentage of grain over straw in this case was worst of all, though there was no defect in the quality of the grain. Even with saltpetre the ashes do not seem to have ever shown any remarkable effect. The experiments with sheep-dung so far as they have gone show that folding sheep on the field is much better than applying rotten sheep dung to it. It is rather surprizing to notice that poudrette has remained behind the cattle dung. Saltpetre alone and with bonedust has always left some margin of profit after recovering its own cost but being a purchased manure, it can hardly be ever a favourite with the common peasants. It is also noticeable that saltpetre made the stalk grow more luxuriantly and produced proportionately less grain. The poor yield of saltpetre combined with superphosphate is not very easy to explain. Probably the excess of acid present with the super had acted on the nitrogen, and converted the latter in the presence of lime into some compound not easily available to plants; the nitrogen of nitre might also have partly escaped as ammonia or free nitrogen. A new set of experiments has been designed to test the theory of English farmers that the best and most economical manure for a farmer is the cake-fed dung. The experiments so far as they have gone have proved favourable to cake-fed dung but as yet it is too early to pronounce any opinion on them. Growth of wheat year after year on the same field exhausts the soil first of its nitrogen, so that if the latter element be supplied from time to time, the successive growths of wheat on the same field may be continued for much longer time. Green manuring with indigo and hemp has proved to be good and economical fertelizer. Sowing wheat after lucerne is just as good as cropping it after indigo. Another series of experiments in which six plots were being continually cropped since the last six years and never manured during that time shews that simple ploughing whether deep or shallow is no good. But to fairly compare the results of deep and shallow ploughing the plots require manuring. Mr Smeaton, the Director of Agriculture for the United Provinces, has recommended the incorporation in future of the rabi season report on the experimental station in the annual report; but it would be a great pity if the report under question embodying such valuable collection of facts of the oldest and best managed agricultural station in India be not published separately and judged on its own merits. The practice of issuing two reports on the working of the station,—one on the rabi season and one on the kharif season has long been in existence and the break, if one be stopped, in the continuity of the system in which results had hitherto been recorded and published will seriously interfere with showing comparative results in future.

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VETERINARY SURGEON J. H. STEEL remarks in the *Veterinary Journal*:—"The Burman pony has long been known in India as the Pegu, but at present there are at least three kinds to be obtained in the market. Of these, the first is the *Shan* pony, periodically brought down by its owners from the table-lands of the state between Burmah and Siam. They are of sizes ranging to a little over twelve hands, very variable in colour and also in physique. The most peculiar, those pointed out as true, pure-bred Shans, attracted my attention at once, *as being perfect little cart-horses* with Roman noses, intelligent expression, stout necks, low withers, upright straight forelegs, with short pasterns, large hairy fetlocks, and wide, open flat feet; chests of most extraordinary breadth, round barrels, goose rumps, the tail being set on very low down, and short thick hocks. These cart-horse-like ponies are highly valued as weight-carriers, and fetch a high price in the Rangoon and Moulmein markets, but less admirably made ponies are the rule, and may be had at moderate prices, especially at the latter place. The second kind of pony is the *Mandalay*. He is altogether a lighter and rather larger animal, with a certain touch of eastern blood probably derived in times past from chargers presented by European adventurers to the king or nobles of Burmah as an acceptable form of donation. He is well-made, and handsome, well suited for harness or riding purposes, with very good trotting powers and excellent constitution. The *half-bred* is the third variety. He is got by Government stallions out of country pony mares, and proves much faster than the pure native animal—so much so that it has been found necessary to protect the latter by the formation of a Burmah Turf Club, and the establishing of regulations as to terms of running for ponies according to caste. The pony-breeding operations are under the

supervision of Mr. Frost. The half-breed fetch good prices, and are much appreciated by a large section of the Rangoon community; but there is another and large party which considers that the ponies in Burmah are now less robust for work and sturdy in constitution than formerly."

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INDIGO NOTES.—The following is the annual indigo market review by Messrs. Stanbury & Co. of of the Mincing Lane:—"Indigo has been no exception to the general run of articles in Mincing Lane, and offers no satisfactory retrospect to imports. A small crop of Bengal, following five years of plentiful supplies, naturally produced enhanced values, and caused prices current during the Calcutta season of 1885-86 to rise unmistakably, and in many instances above the London quotations. The early arrivals in the spring showed badly, when brokers' valuations were compared with the cost, and many parcels were held back in consequence, only to meet with worse results as the year advanced; losses as much as 1s per lb, were recorded in many instances. The causes which operated adversely during the year can not only be attributed to the general depression of trade, but also to what is called the "invisible stock" (being the stocks accumulated in private warehouses, both at home and abroad, the necessary result of large supplies), and which not being worked off, caused dealers to restrict their usual purchases. We have every reason to believe that these private stocks are much reduced, and the amount of the Bengal crop this season will, with present comparative low scale of values, cause a steady trade as the new year proceeds. From Madras we have received 9,748 chests which repesent a fair average supply; the quality, however, has been generally very ordinary, the sandy blue sorts of Kurpah preponderating, whilst the desirable red descriptions were conspicuous by their absence. Dry-leaf has been very scarce throughout the year, and is at present very difficult to purchase; prices have been well supported. Many chests of Kurpah received this year have been found mixed with aniline, clay, and other spurious matter. It is necessary to point this out to shippers, in order that their consignments of Kurpah should not be thus prejudiced by false packing. The following tables of course only give the stocks and consumption of East India indigo in Europe, as assertained from public warehouses and which show an apparently large falling off in the consumption as compared with last year's—an assumption, as explained above, which is certainly not so bad as the figures would lead us to expect.

The large importations of Bombay kinds, after years of comparative absence, represent an amount of 4,000 chests. The description known as "hoodie" has gone freely into consumption, but the button sorts, which were generally very ordinary, have been difficult to realise, and prices obtained have shown no encouragement to owners to continue further consignments. The Bengal crop for the last ten years has averaged 130,000 maunds (which amount represents the crop now in course of shipment from Calcutta), or 33,000 chests. Of these, it is probable that America, the Gulf Ports, &c., will take at least 10,000 chests, thus leaving a supply of 23,000 chests available for European wants. The consumption of East Indian indigo in Europe is thus arrived at:—

	chests.
European stock 31st December, 1885 ...	11,200
Receipts from Calcutta in 1886	19,733
" Madras, Bombay, &c., in 1886 ...	14,600
	45,530
Deduct present stock ...	12,000
Leaves ...	33,530

Prices are now on a very low scale, especially for middling and good Bengal: it has been calculated that they are as much as 1*s*. 5*d*. below the average of the last twenty years, whereas ordinary Oudes are only 6*d* below the average of the same period. Of the Bengal crop in course of shipment, about 62,000 maunds are now sold.

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SOAP, SODA, AND OTHER CLEANSING MATERIALS.—Dr Stevenson Macadam lectured, under the auspices of the Edinburgh Health Society, in the Free Assembly Hall, on "Soap, Soda, and other Cleansing Materials." Dr Macadam said that in early times people were in the habit of using natural substances, such as the juice of plants, the ashes of plants—which yielded what was now known under the name of potashes—and natron corresponding to our soda. The remains of a well-organised soap factory were found in the ruins of Pompeii. Soap factories existed in Italy and Spain in the 8th, and travelled to France in the 9th century It was about the 14th century before they heard of soap being manufactured in Great Britain. Since 1622 they might consider that the manufacture of soap formed one of the technical industries of this country. The amount of soap used per head of the nation was now generally regarded as an index of the advance made in civilisation. White soap was generally prepared from tallow accompanied by a little lard and palm oil. The difference between white and yellow soap lay in the incorporation of the soap with tallow or palm oil or fatty substance, used with a certain

proportion of resin or rosin, the latter combining with the washing soda. Soft soap was prepered from fatty substances, accompanied by potass. Cocoanut-oil soap had the advantage of being used with sea-water, and was often called marine soap. Carbolic acid soap was prepared by boiling fatty substances with soda, or taking ordinary soap, heating it, and putting in about two per cent. of carbolic acid. This description of soap possessed the disinfecting properties of carbolic acid, besides the qualities of ordinary soap. Toilet soaps were very well represented in what was known as old brown Windsor soap, though, he was afraid, the old brown Windsor soap did not nowadays get time to age. Some of the transparent soaps were also very good. Prepared in the right way it was ordinary soap of good quality cut into shavings, dried, and treated with alcohol. The alcohol evaporated, and during evaporation it left the transparent soap. This treatment had the effect of taking all the soda out of the mixture. He could not say much in favour of soap powders, which were often employed as an aid in washing clothes. This mixture consisted principally of washing soda and a little soap. He exhibited a packet which claimed to be "the best and cheapest composition ever discovered for washing and bleaching all kinds of woollen and linen goods without the pernicious effects of soda and potass." He had examined it, he said, and found that it was nothing but washing soda. It was charged 1*d.* a packet, or 6*d.* per lb., and he could buy washing soda in any shop at the rate of 2 lbs., for 1½*d* He commended the use of borax powders for washing purposes.

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RETURNS OF RAIL-BORNE TRAFFIC OF THE PUNJAB FOR QUARTER ENDING 30TH SEPTEMBER 1886.— Both the import and export trade of the chief articles of commerce, affecting more especially the trade with Karachi show a further falling off. That with Bombay has not declined in anything like the same ratio, which would seem to point to the fact that the trade of the province is gradually being drawn away from Karachi to the more distant port of Bombay. The total imports have fallen from 970,696 maunds during the quarter ending 30th September 1885, to 819,784 maunds during the same quarter of this year. The decrease in imports has chiefly occurred in salt from Bombay; in metals from Karachi and Howrah, Bombay showing a slight rise; in jute, and in European cotton-piece goods, the import of which from the port of Karachi has fallen from 58,384 maunds to 35,150 maunds, as compared with last year; in coal, the importation of which into the Punjab has fallen by 40,000 maunds, and in gram, of which grain, however, there has been a very considerable increase of exports. The imports of rice, chiefly from the North Western Provinces and Oudh, have risen. The decline, as compared with last year, in exports is even more remarkable but here again the Karachi trade has suffered out of all proportion to the Bombay trade. The total exports have fallen from 5,995,183 maunds during the quarter ending 30th September 1885, to 2,896,715 during the quarter under report, or more by half. The export of wheat has fallen from 4,522,3?0 maunds to 1,592,152, being a decrease of 2,100,000 maunds from Karachi alone. The exports of mustard and rape seed has decreased by fully one-half, Karachi again bearing the greater portion of the loss. The exports of salt and sugar from the province has also considerably declined. It is somewhat remarkable that while the export of all other grains has much diminished, that of gram has risen from 367 682 maunds during the same quarter last year, to 538,513 during the present quarter, the increased export to Bombay being very marked having risen from 1, 792 maunds to 41,747 maunds. The export of raw cotton, chiefly to the seaports, has risen from 3,000 to 13,000 maunds.

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MR. FINUCANE ON AGRICULTURAL PESSIMISTS.—It may be admitted that attempts hitherto made by Government at starting model farms, and introducing agricultural improvements in Bengal, have not been very successful; but that result is, in the opinion of Mr Finucane, due to the fact that when the persons in charge of these experiments, such as Scotch gardeners or persons of that class, knew something of agriculture they knew nothing of India, and were incapable of understanding the habits of the people with whom they had to deal, and of accommodating themselves to them; and when, on the other hand, they were cultured gentlemen capable of understanding the country and the people, they had no knowledge of agriculture, except such as they had acquired as amateurs by way of pleasurable relaxation from more serious pursuits. Bengal graduates, returned from Cirencester, after a few years' experience and observation of the agricultural practices and habits of their own countrymen, are not likely to fail in either of these respects. "We have no hesitation," says Mr Finucane, "in saying that our doctors can teach something better than the native systems of medicine, though the native hakims are possessed of the empirical knowledge resulting from the experience of all the ages; neither do we doubt that Western science, has something to teach the East, in engineering, in law, in the art of Government, in those metaphysical and philosophical pursuits which are

so congenial to the Oriental mind. Government undertake to teach the people the knowledge of their own Oriental languages; Government teach them painting, philology, archæology, even riding and athletics; yet, as to agriculture alone, for which science has, within the last fifty years, done as much in Europe as for any other art or business, it is sometimes maintained that Western scientific knowledge can in India do nothing; and this though the art of agriculture as at present practised is more rude and primitive than that described in the earliest records of ancient Rome, though the agriculturist still guides his plough-cattle by twisting their tails, though he has so little appreciation of the value of manure, that he is now allowing bones to be collected and taken gratis from his very door, and to be exported for manure from Calcutta to the Straits Settlements, Mauritius and England, and as though the operation of the laws of nature becomes suspended when a Bengal ryot is concerned with them. On the contrary, when Behar or Bengal ryots are not treated like dumb, driven cattle, and it is deemed worth while to get their *bona fide* assent to engagements, that they faithfully abide by those engagements; that, like all poor and hard-worked people, they are keenly alive to considerations of pecuniary gain, and therefore that they will in due time adopt any improvements which are really shown to be profitable and within their limited means. If the Government had endeavoured during the past century to train up skilled agriculturists, and to introduce agricultural improvements, in the same way as they have trained lawyers, doctors, and engineers, it does not appear, too much to say, that the Government should have effected as great reforms in agricultural, as they have effected in other pursuits. It would appear to be much better, to spend lakhs of rupees yearly, in the development of a system of real agricultural education, such as prevails in Germany, France and Italy, than it is to spend large sums in what is now called higher education, or in the construction of bridges, jails, and other public buildings, which, however useful, are not indispensable. France and Germany each spends about fifty thousand pounds per annum on purely agricultural education. If the Governments of Denmark, Belgium, Germany, and France find it wise and prudent to spend large sums in providing agricultural education for the shrewd, intelligent, and well-educated peasantry of these European continental nations, it is surely no waste of public money for a Government like ours, which in all other subjects is deemed to be so much in advance of the people, to spend a small amount in the investigation and development of an industry which, important in every country, in this is vital. In no other country is it supposed that the empirical knowledge of the cultivator is perfect and complete; that agriculture requires no study, or the management of estates no special training or knowledge of agricultural affairs. In this country where everything is new to the governing authorities—the tenures, the crops, the modes of cultivation, the system of accounts—a young Civilian or Deputy Collector fresh from town life, school or college, military men without special training, European planters who may have been unsuccessful at their own profession, and even office clerks and subordinates who may have given satisfaction to their superiors, are found in charge of large estates, which in England would be entrusted to nobody but a trained agriculturist or country gentleman experienced in agricultural affairs. A beginning should therefore be made, in the way now indicated, in training an agency capable of intelligently observing agricultural facts, and of managing Government estates. Such an agency, with scientific training and the caution that scientific methods impose, would be as averse to reckless and needless innovation on the one hand, as it would be to hasty generalizations and dogmatic assertions of the impossibility of improvement on existing practices on the other.

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TRADE OF INDIA.—During the past ten months from April to December, the total value of merchandize imported into British India was Rs.43,63,80,921 against Rs. 37,87,55,902 during the corresponding period of the previous year, and the total value of merchandize exported amounted to Rs. 59 86,40,320 against Rs. 56,07,77,716 in the corresponding period of the last year, being an increase of Rs. 3,78,62,804. The gross amount of import duty collected during the period was Rs. 1,88,88,807 and the export duty Rs. 36,02,731, showing an increase of about 15 lakhs in the former, and a decrease of about 4 lakhs in the latter. As usual the greatest money value of import was under the heading of yarns and textile fabrics and the greatest money value of export under the heading of raw materials and unmanufactured articles.

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SABE, SABAI, OR BABUI GRASS (*Andropogon involutus.*)—*Sabi* is not a product of Tirhoot, but is imported from the foot of the Nipal Hills. The consumption of the grass in the form of string, varies with the distance from the source of supply. It is very little used in the south of Durbhunga district and very largely used in the northern parts of Chumparun. In the latter district it is grown to some extent on the land bordering on Nipal. Locally the grass is used only for making into string, but last year the grass in the part of the

district referred to, was bought up for export and the whole has this year been secured. The grass exported from Chumparun last year went directly to the Bally Paper Mills. In Monghyr district the grass is grown all over the Kharakpore range of hills, it is exported thence to Patna and other neighbouring markets, and large quantities would be available. The local price is about Re. 1-14 per maund. The only purpose for which it is used is for making into string, and it is sold both as string and in its unmanufactured state. The grass is grown also on the Rajmehal Hills. In Chota Nagpore the grass, known there as Babui, is in some parts *cultivated* it is grown in Manbhum District, especially in Burrabhum and Patkum in *[redacted] the Bhuskar jungle in sub-division Jamtara, Nya Dumka District; large quantities may be procured manufactured into string; it is sold at Rs. 3-2 to 3-12 per maund and exported to Bankura, Raneegunge and Calcutta. The raw product, it is said, is not exported, but can be purchased in February to May at from 12 annas to a rupee a maund. The only use to which it is put is in making string. In none of the districts is the grass used for any purpose but making string for many varied uses.

BENGAL SILK.—A superior quality of silk called *gorad* is still woven at Mymari, Radhakantpore, Panchkoola, and Jugdabad, in the district of Burdwan. It finds a ready market in Calcutta. A pair of silk cloth 10 yards long is sometimes sold at Rs. 22, and a piece of equal length from Rs. 12 to Rs. 20, according to the quality of the fabric. The estimated outturn was 16,900 yards valued at Rs. 21,000. The manufacture of silk in Baukoora is almost entirely confined to the towns of Bursingha, Bishenpore, and Sonamukhi. The first named town is, however, the seat of the manufacture. There are 20 looms in it which work in silk only. The Bursingha and Sonamukhi looms generally turn out the staff called *kootni*. The Bishenpore weavers have obtained great excellence in the art, and have obtained prizes and honorable mentions at India and foreign exhibitions. There is some demand for the staff called *kootni* in the North-Western Provinces. It is used in making screens and quilts by Europeans and native gentlemen. In Midnapore silk fabrics are manufactured in some parts of the Sudder sub division to a smaller extent, and to a greater extent in the Ghatal subdivision. Two hundred and fifty-one maunds 21 seers of silk were manufactured in this district, the value of which is estimated at Rs. 1.31.554. Business was very dull on account of continuous fall in the price of silk and on account of the degeneration of cocoons. In Beerbhoom the manufacture is confined to the factories in Gonotia. The outturn was 232 maunds, worth Rs. 1.87,031, against 300 maunds valued at Rs. 1,64,914, in the previous year. The decrease is due to a reduced supply of cocoons. Besides the above, about 21,400 pieces of *kora* (each 7 yards long), estimated value Rs. 1,50,000, were exported by the agents of different merchants and dealers to Calcutta. The manufacture of silk in Hooghly and Howrah is in the wane, and does not require special notice. Tussur silk cloth is manufactuaed in all the three district of Burdwan, Bankoora, and Beerbhoom. In Midnapore also tussur cocoons are obtained from the jungle mehals, and are reeled and manufactured into cloths in parts of the sudder and Ghatal subdivisions The principal seat of the industry in Burdwan is at Bagtikari, Moosthol, and Ghoranush, in the Cutwa subdivision. The cocoons are imported from the districts of Moorshedabad and Chota Nagpore. Over 200 persons are emploed in this manufacture. The outturn is estimated at 30,010 yards, valued at Rs. 40,242. In Bankoora the principal seats of the industry are Bankoora, Beersinghapore, Sonamukhi, and Bishenpore. The supply of tussur cocoons in the district is not adquate for the requirements of the manufacture. Large importations are therefore made from Chota Nagpore. The tussur cloth finds a ready market in Calcutta and North-Western Provinces. The value of the fabrics produced is estimated at about Rs. 20.000. In Beerbhoom 21,500 pieces of tussur, valued at Rs. 1,40 000, against 17,460 pieces to the value of Rs. 96,030, were exported from the weaving centres of Kaddya Beershinghapore, Parulia, and Tantipara. The demand for this article from Europe is on the increase. The number of silk factories which worked in the Moorshedabad district during the year was 72. They produced 200,911 lb of silk, valued at Rs. 18,03 914. The silk industry it is said, is not profitable. The depression is attributed to a strong competition in the European market of Italian silk. Silk cloths of a superior quality are manufactured at Mirzapur and Baluchar. It is stated that of late there has been a rise in the price of silk, and it is now selling at Rs. 10 a seer, against Rs. 8 before. There was again a falling off in this industry in Rajshahye. The quantity manufactured and exported by the two European firms was 113,400lb against 133,633lb. By way of giving a stimulus to the silk industry a cocoon exhibition was held in Beauleah by order of Government in January, and Rs. 1,920 were distributed in rewards. Mr. Wardle, a silk expert, visited some of Messrs. R. Watson and Company's silk filatures during the cold season. The district officer understands the French firm Messrs. L Payen and Company are

pushing the manufacture of tusser silk on a new principle. The manufacture of tusser and bafta pieces by the weaver in Champanagore, Nathnagore and Khanjarpore of Bhagulpore is still mentioned. The outturn during the year under report is estimated at 21 417 pieces valued at Rs. 1 13,088, as compared with 44,555 pieces worth Rs. 1,91,500 in the previous year; the figures show a sad falling off, and this too must be written down as a decaying form of industry. There are five silk factories in the district of Maldah under European management, besides numerous native silk filatures The season was not a good one, as the worms were not so plentiful as usual, the mulberry having suffered severely owing to the drought and great heat during the first three months, and the heavy rainfall and floods during the latter portion of the season. This, too, is a gradually decaying branch of industry. The demand for silk appears to be falling off. and is insufficient to maintion the industry in its formerly prosperous condition. In Hazaribagh the manufacture of tussar silk is said to have received an impetus owing to the establishment of a filature in the town of Hazaribagh by a French gentleman who is working in cocoons on the improved method. The industry is said to have been very much depressed in Manbhoom in consequence of the large export of raw silk to Europe and the consequent rise in the price of the raw product."

TRADE IN LINSEED.—Owing to the failure of the linseed crop in Russia and to a strong demand which existed throughout the year for this article in England, the trade received a great stimulus during the year 1885-86. At the beginning of the year, owing to the probability of a war between Russia and England, there was a strong demand for linseed for several weeks during the time that negotiations were in progress. When, however, it was seen that the difficulty would be amicably arranged, a quieter feeling set in. This did not last long, for there was throughout the year a strong demand, at occasional intervals, and prices were much in advance of those ruling in the previous year. The extremely low freights during the past year have probably had some effect in producing the increase as the advantage in this direction possessed by the ports on the western side of India cannot have been so great as in ordinary years of high freights when the difference in rates would be greater than it was last year. Another factor which no doubt would contribute to the advance in shipments is that during the year the rates of carriage for oilseeds were reduced by the East Indian Railway, which, causing a decline in the cost laid down here, also placed exporters in a better position to compete with Bombay and Kurrachee.

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TRADE IN HIDES There was an increase of 10¾ per cent. in the exports of raw hides during the past year in comparison with 1884-85, There were advances in shipments to the United Kingdom, France, Italy, and the United States, with a decline to Austraia. The market here throughout the year generally was in a very quiet state, and there was not much fluctuation in prices, which, however, were lower at the close of the year. There was a little or no support received from the English markets, so the trade in these goods was irregular with considerable fluctuations in prices which on the whole declined during the year. The United Kingdom takes the lagest quantity of raw hides from Calcutta, the shipments thither being more than one-half the total quantity exported. There was a small increase in the exports during the past year for which no special reason can be assigned, it probably being an ordinary fluctuation of trade. There was a decline in shipments to Austria of 32½ per cent., to which country the exports in 1884 85 were the largest shown, and a falling off in the succeeding year was therefore not improbable. The advance in the exports to Italy is very marked and the expansion of this trade has been remarkable during the past ten years, the total shipments in the past year being more than double what they were in 1876-77. The regularity of communication between Calcutta and Italian ports has no doubt had some influence in producing the increase shown. To the United States exports of raw hides have again advanced and the figures are the highest shown. There has evidently been an accumulation of stocks in the United States, as shipments of leather have been made to Canada which were sold at very low prices. The trade in tanned hides has fallen away to a very small proportion, and the figures are of comparative insignificance.

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BENGAL TOBACCO-The extent of tobacco cultivation is not great in Rajshahye. It is largely grown within the sudder, Melphamari and Kurigram sub-divisions of Rungpur and constitute one of the principal articles of the export trade of the district. The chief centre of the trade in the district is at Chpalopak on the Teesta where the process of rearing, bundling, &c., is extensively carried on. The cultivation of this crop is gradually extending in the Dooars, but as yet it is not well understood there. Along the road from Salbaree to Alipore very fine tobacco is grown. The Hingli tobacco of Nuddia is well known for its quality, and commands a good price in the market. In the year under report the crop was

successful, and it is reported that the export was 1,17,700 maunds.

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The interesting account of the state of agriculture in Belgium, contained in an official report written by M. Gosselin, has been referred to as follows in the *Standard* :—Out of the total population of 5,750,000 there are nearly 1,200,000, or 21 per cent. engaged in agricultural pursuits, while fully one-third of the people are supposed to be more or less directly interested in the cultivation of the soil. Wages for farm labourers, without food, vary from 1s. 3d. to 2s. 3d. a day for men and from 10d. to 1s. 4d. for women. When food is given, men usually receive 1s. and women 7d. The total area of land under cultivation is about 6,681,000 acres. Great efforts for the development of agriculture have been made by the Government, through the agency of the Department of Agriculture and Public Works. Experimental stations, nine in number, have been established in different parts of the country, the expenses being defrayed partly by the State and partly by local agricultural societies. Special attention is paid to chemical experiments, manures, and varieties of crops best suited to Belgian soil. There are three free Agricultural Schools; supported by the State, as well as a School of Forestry, the Agricultural Institute at Gembloux, a Veterinary School, and two Schools of Horticulture and Arboriculture. Courses of agricultural lectures, too, open to farmers are given at 29 middle-class State Schools. The estimates of the Agricultural Department, in 1886, for the expenses of the institutions and lectures referred to, for veterinary and sanitary police, for indemnities paid to owners of diseased cattle slaughtered by order, for encouraging the improvement of live stock, and for various departmental outgoings, amounted to about £75,000. The last census gave the following as the numbers of domestic animals of the several classes :—Horses, 271,974 ; cattle, 1,382,815 ; sheep, 365,400 ; pigs, 646,375 ; poultry, 3,967 000. Belgium has not escaped the agricultural crisis common to other countries. The value of land has fallen from 25 to 30 percent., and the small proprietors, who own nearly all the agricultural land, have suffered seriously. Sub-division having been excessive, the small portion of land coming to one of a number of children when the father dies realises very little if sold, and it is commonly too minute to afford a living. Where land is let, rents have been much reduced, and yet many farmers have been unable to pay them.

* * *

POPPY IN BEHAR—The whole area under Poppy cultivation in the Behar Agency in 1885-86, was 4,63,516 bighas. The produce at 70° consistence was 59,865 maunds odd seers. The average yield per bighah was 5 seers 4½ chuttacks. There were 1265 prosecutions for breach of the opium law during the year, in Behar and Benares, and in the majority of cases convictions were obtained. The most important seizure reported was that of 19½ maunds of opium discovered in Azimgunge, packed in tobacco. It is said that very little opium pays duty in the producing districts, the inference being that such consumption as takes place is almost exclusively illicit, and the evil is not, it is said, confined to those districts, but that a regular system of smuggling is carried on for the transport of the drug to distant places.

1. Forecast of the Crop raised from September to November 1886. From the Government of Madras.
2. Memorandum on the sowings of the late Crops in the Madras Presidency, From the Government of India,
3. Memorandum on the Prospects of the cotton crop in the North-Western Provinces and Oudh. From the Government of India,
4. Report on Arboriculture in the Hyderabad Assigned Districts for the year 1885 86, From the Government of India,
5. Report on the Revenue Administration of the Punjab and its Dependencies for 1885-86, From the Punjab Government,
6. Memorandum on the Prospects of the mustard crop in Assam. From the Government of India,
7. Memorandum on the Prospects of the Cotton Crop in the Punjab. From the Government of India,
8. Memorandum on the Prospects of the Burma Rice Crop From the Government of India,
9. Memorandum on the Prospects of the ground nut crop in the Madras Presidency, From the Government of India,

To

THE EDITOR OF THE

Indian Agricultural Gazette

Dear Sir

Will you or any of your numerous readers kindly let me know whether *crude* saltpetre can be procured in Calcutta. If so, from where and at what price.

Calcutta,
The 4th February 1887.

Yours faithfully,
J. C. ROSTAN.

TO THE EDITOR OF

The Indian Agriclutural Gazette.

SIR,

It seems to me highly desirable that before committing ourselves to any course of action with regard to technical education, we should take an accurate survey of our position and requirements. Technical education embraces a host of widely different subjects from medicine and engineering down to shoe-making. As we can not possibly have them all, we should select a few of them such as are likely to be most conducive to the well-being of the community. The test of competition will mainly decide between the claims of contending industries ;—it will be enough, for instance, to enquire whether an industry introduced into India will be able to hold its ground against English goods on the India market. Many of the industries to which we are so anxiously looking forward are well nigh impossible in India, since the solemn pledge of Free Trade which the Government have given to English Commerce has driven all idea of protection to the winds. I am afraid there is a vein of bitter irony running through our over-sanguine expectations of technical education. We are asked to believe that technical education will ere long fit India to play her part as a great industrial country. But how, may I ask in the name of all political fallacies, can India ever be a great industrial country in the teeth of Free Trade ? What boots it that India has no equal in the world for her natural resources ? She does not possess the skill and experience of Western nations ; and it is not a month or a year in which a nation can be adequately brought up to an industry. The young industries of India if they be ever called forth into existence will have to struggle against the agressions of foreign commerce ; and unless the Government of India do lend them an adequate measure of protection in their infancy they can not live to be older and stronger and fight their own battles.

I have been led to the above remarks, however trite, from the conviction that while we readily recognise a law in theory, we are often apt to ignore its practical application. It appears to me that the eyes of the nation are never so completely spell-bound as at this moment by the fascinating vision of a great industrial future for India when the only circumstance which can make the growth of industries possible in this country is notoriously wanting. Let us, therefore, take full cognisance of this fact that so long as the Government of India continue to receive their counsels from Manchester, there is very little hope for any great industrial development. In framing a scheme of technical education, the test of competetion should be jealously applied, and all such industries as do not satisfy it carefully excluded. Which industries are then likely to stand the test ? If I were asked this question, I should broadly answer—they are those which employ the least amount of machinery and the greatest amount of raw materials and manual labour. I am not in a position to pronounce a verdict, this way or that, on any particular industry; and accordingly leave this difficult task to men better conversant with the resources of the country and the special requirements of each industry.

In conclusion I should like, however, to lay stress on a particular industry which has as yet little engaged the attention of the public. I mean no other than agriculture. Agriculture has always been, and shall always continue to be the main stay of our national wealth. However great our industrial achievements may be, agriculture shall always be at the head of every other industry. Is it not therefore desirable that the main current of our national enterprize be directed to the pursuit of agriculture ?

Technical education has a two-fold value, in the first place, it trains its recipient in the pursuit of a particular industry, and in the second, it awakens in his mind a spirit of enterprize constantly seeking for employment. With regard to agricultural education, I am inclined to attach greater importance to this, the latter and indirect side of its utility. It is widely known that the deplorable condition of our University graduates is a pure outcome of the conservative instincts of the Indian society. The educated young man is ready to jump to any extremities in religion and politics, but his habits of action remain as unalterable as ever. His love for the desk is incurable, his contempt for any work having the least show of manual labor is notorious. The problem of to-day is how to prepare him for an industrial life and the best and ready solution that I can just lay my hand on, is technical education. As a counterpoise to national lethargy, agricultural education will be found to be more effectual than any other branch of technical education. For agriculture is the industry with which the Indian mind is most intimately associated; besides as it offers the largest field of employment, and the surest chance of success, it is likely to prove an invaluable school for preparing the nation for higher and more complicated industries.

Yours truly

B. C. BASU.

RURAL ECONOMY
OR
Agricultural Analysis of Villages.

Nothing is more essential to efficient administration of a country than a clear insight into the condition and circumstances of the rural population which constitutes its back bone and if this be true of all countries in the world, it is more so of India which is pre-eminently or almost exclusively agricultural. Every village should have a detailed analysis showing its products, number and distribution of population, cultivation and grazing area, communications, average rainfall and its distribution, irrigation, livestock; in fact an accurate record of all fiscal and agricultural conditions. Taking villages for its unit, analysis should extend over larger areas till whole provinces are included in it. A beginning has been made for such an analysis in every province excepting Bengal where there is no agency whatsoever for the purpose but where the want has long been felt of the collection and embodiment in convenient forms of the statistics of vital, agricultural and economic facts, in order that Government and its officers might always be in possession of an adequate knowledge of the actual condition of the country, its population and its resources, a want which has been acknowledged by responsible officers of Government to have baffled all attempts at administrative reforms.

Fully alive to the importance of such collection and embodiments of facts, we got together and published last year a series of notes on the Rural Economy of Shahabad, and found out that it was wholly impossible for private bodies or individuals to do any thing like full justice to an undertaking of such vast magnitude and that nothing less than the agency of Government can ever hope to execute it. We therefore welcome with pleasure the signs afforded by our agricultural officers that they have given their best attention to the subject with the time and the means at their disposal. A description by Mr. Sen of the rural economy of a village in Burdwan somewhat on the lines laid down by us in our notes on the rural economy of Shahabad will be read with interest.

Like most villages in the Burdwan district, Moyna is a mixed village of agriculturists and men belonging to other professions.

It is about seven miles from the Memari station on the East Indian Railway line, and is a little more than a mile from the metalled leading road from that station to Chakdighi, a considerable village in the Burdwan district. The Eden Canal passes within two miles of the village but the regulator by which water is obtained for irrigating a portion of the village lands is five miles off.

The soil of most part of the village is a peculiar sandy loam of a greyish-white colour, in which the plant called *gholghasa* grows very luxuriantly, and is a troublesome weed to eradicate. Similar soil is found occupying limited areas all over the division and in the Tipperah district, and, so far as my observation goes, it is always characterised by same plant. In appearance as will as in text it is very different from laterite clay and red sand prevailing in the western and central parts of the division.

The village consists of four patties, viz, Sripur, Dattapur, Jagadispur, and Mansingpur, of which the first belongs to a Zemindar of British Chandernagor, and the rest which belongs to the Burdwan Raj, is let in patni to the Babus of Bhastara. Nearly a fourth of the village forms, rent-free tenures (lakhiraj.) The ryots have for the most part mokurrari rights, and are not liable to eviction or enhancement of their rents. The landlords in consequence are quite indifferent to the improvement of the village.

The village and the land pertaining to it cover about 1,532 bighas, divided thus :—

				Bighas.
1. (*a*) Bastu land	...	...	...	70
(*b*) Udbastu land	...	...	...	60
2. Arable land	...	...	...	1,202
3. Uncultivated and waste lands	...		...	200
			Total ...	1,532

The great extent of the udbastu land or forsaken village sites as compared with bastu lands shows that it is due to the great mortality which was caused by the epidemic fevers during the years 1869—1888.

The arable land was distributed under the different crops in 1885 thus :—

				Bighas.
(1) Paddy	...	...	...	1,042
(2) Pulses	...	...	...	145
(3) Sugarcane	...	...	...	1
(4) Potatoes	...	...	...	9
(5) Onions	...	...	...	2
(6) Barley	...	...	...	2

The total population of the village consists of 564 souls distributed the :—

1. Age and sex—(1) Adult—(*a*) male	...	188
(*b*) female	...	210
(2) Children	...	166

	Male.	Female.	Children.	Total.
2. Caste, &c.—				
1 Brahmin	6	14	6	26
2 Kaestha	19	30	28	77

	Male	Female.	Children.	Total.
3 Sadgop	33	48	38	119
4 Tamli	7	8	5	20
5 Kamar	2	4	3	9
6 Napit	5	2	1	8
7 Goala	36	36	30	92
8 Baistab	7	4	3	14
9 Jugi	3	1	6	10
10 Bagdi	9	10	7	26
11 Dule	24	17	16	57
12 Hadi	11	8	10	29
13 Dhoba	4	5	6	15
14 Chandal	7	5	9	21
15 Moyra	0	2	0	2
16 Sankari	3	4	0	7
17 Kansari	3	2	2	7
18 Mahomedan	5	6	2	13

3. Profession—

	Male.	
Servants (superior)	12	
Tradesmen	16	
Cultivators	75	106
Agricultural labourers	31	
Others	54	

1. Working bullocks—

(1) Plough	135
(2) Cart	2

2. Milking cows and calves—

(1) Cows	217
(2) Calves	217

3. Sheep and goats—

(1) Sheep	20
(2) Goats	83

There are 65 ploughs at work in the village.

The implements used by the cultivators—

	Prices. Rs.	A.	P.
Plough	2	0	0
Yoke	0	6	0
Kodal	1	0	0
Sickle	0	4	0
Pher	0	1	0
Harrow	1	0	0
Langli (small plough)	0	8	0
Simni	0	2	0
Donga	5	0	0
Ladder	0	2	0
Palan (bullock saddle)	2	0	0
Campa (sunn strap to bind sheaves with)	1	0	0
Goon (a sunn bag)...	1	0	0

About 100 bighas are irrigated from the Eden Canal. There are about 30 tanks for irrigation purposes in the village. These have all been filled up with silt and overgrown with weeds. The oldest men in the village cannot say when these tanks were dug, and whether they were ever repaired. Most of the village lands are dependent on rain water. There are no wells in the village.

The water-lifts used are siuni and donga.

The agricultural servants are paid partly in cash and partly by food and cloth—

	Rs.	A.	P.
Cash	2	8	0
Food and cloth	3	12	0
Total ...	6	4	0

The amount paid in cash is sometimes a little less than what has been put down above, but the average total monthly salary will not be less than Rs. 6.

Day-labourers ordinarily get 3 annas per head. This amount is nearly doubled during the harvest time. Carpenters and blacksmiths get about 8 annas a day each.

The wages are increasing, and during the last 10 years have increased 30 to 40 per cent.

For repairing any agricultural implement, the ploughs, sickle, kodali, &c., the village blacksmith who also does the work of a carpenter, is not paid in cash, but gets as many as 12 aris (49 seers) of paddy for each. Payment is made in cash when a new implement is made.

There is a hat (market) held twice a week at a place between the villages of Moyna and Nabagram. The things generally sold are vegetables, pulses, and oil-seeds, cloths, iron implements and basins, cheap silver and gold ornaments, penknives, pencils, papers &c. There are two shops in the village and two more in the neighbouring village of Nabagram. The things kept in these shops are cloths, rice, dal, salt, spices, sweetmeats, and household brass and kansa utensils.

The village is connected with the Memari Chakdighi road by a kacha road. Carts and bullocks are generally used to carry things from village to village.

Freight—

(1) By cart, 3 pies per maund per mile.

(2) By bullocks, 9 pies per maund per mile.

Bullocks are used where there are no cart roads.

One cart can carry 16 maunds.

One bullock can carry 2½ maunds.

The ryots generally sell the produce of their fields as soon as the harvest time is over. They sell mostly to grain dealers. The difference between the rates at which the cultivators sell their grains at the harvest time and the prices at which these articles

are sold afterwards is not much in ordinary years, but it is considerable in years of famines or when there may be a great demand in foreign market:—

	1885 Harvest time	1885 Afterwards	1886 Harvest time
Paddy ...	... 40seers	34seers	48seers a rupee
Kalai ...	... 16 ,,	14 ,,	21
Mug ...	... 10 ,,	8 ,,	10
Matar ...	... 32 ,,	30 ,,	32
Gram ...	... 24 ,,	20 ,,	24 ,, ,,
Potatoes...	...Re1-2 per md,	Rs2-8 per md,	Re1 4 a maund

other villages or foreign countries 1885—

Article	Quantity	Money value Rs.	A.	P.
Salt	76 maunds.	190	0	0
Tobacco	24 ,,	108	0	0
Treacle	24 ,,	60	0	0
Gur	36 ,,	144	0	0
Oilcake	... 125 ,,	166	4	0
Cocoanut oil	6 ,,	78	0	0
Mustard oil	... 36 ,,	342	0	0
Spices ...	1½ ,,	15	0	0
Wheat flour	6 ,,	24	0	0
Ghee ...	1½ ,,	45	0	0
Rope	... 2 ,,	20	0	0
Cloth	... . ,,	600	0	0
Paddy	500 ,,	500	0	0
Hide salt	... 40 ,,	50	0	0
Kerosine oil	3 ,,	18	8	0
	Total	2,355	12	0

Exports in 1885—

Article	Quantity	Money value Rs.	A.	P.
Paddy	... 600 maunds	600	0	0
Pulses	... 70 ,,	140	0	0
Potatoes ...	... 100 ,,	125	0	0
Rice	... 200 ,,	500	0	0
Milk	... 100 ,,	225	0	0
Curd	... 60 ,,	120	0	0
Chhana	... 250 ,,	1,250	0	0
	Total	2,960	0	0
Saving of villagers engaged variously elsewhere, brought to the village (near guess)		1,344	0	0
	Total	4,304	0	0

The accumulation of wealth per head in the village is Rs. 3-7-3 a year. Most of the amount is absorbed by the Mahajans and Government servants. There are four mahajans in the village.

They lend money as well as paddy. The usual rate of interest is 1¼ pice per rupee per mensem, i. e. Rs. 27-6 per cent. per annum. Paddy is lent throughout the year, and is got back after the harvest time with an interest of 25 per cent. The cultivators are mostly indebted to the mahajans. The debt of each joint family varies from Rs. 10 to Rs. 60.

The average size of the ryots' holding=17 bighas.

1st class	Rs. 4	per bigha.
2nd ,,	,, 2-8	
3rd ,,	,, 2	,,
4th ,,	,, 1-4	,,

Representing the total arable land by 16 annas, there are in the village

1st class land	1 anna.
2nd ,, ,, ...	6 annas.
3rd ,, ,, ...	4 ,,
4th ,, ,, ...	5

The average rental per bigha is therefore Rs. 2 and five pice.

The manures generally used are—

Cowdung, Cowdung ashes, Sweepings of cowsheds } The three put in the same heap.
Oilcake
Hide salt

There are about 30 or 40 bighas of common grazing grounds situated in three different places. For this land the ryots pay nothing to the landlords. Paddy straw is used as fodder and for thatching huts.

There is a pathsala in the village, and a school teaching up to the upper primary standard in the neighbouring village of Nabagram. About 18 boys attend the pathsala, of whom 12 are children of cultivators. The 4 boys of the village attending the school at Nabagram all belong to the cultivating class. The children of the well-to-do villagers receive their education in Burdwan and other towns.

THE METROPOLITAN DAIRY COMPANY, Ld.

For some time we have been watching with considerable interest the progress of a movement which has for its object the establishment of a dairy farm for the supply of pure milk to the metropolis. It will not be amiss, we believe, to review the origin of the movement. We live in an age in which an increasing amount of capital is being daily brought to bear upon every trade and industry. Any great material progress is thus rendered impossible

without a large amount of capital ready to flow into business. This is so very true that even in countries far richer than India, any commercial undertaking on a large scale has long since practically passed out of the hands of individuals into those of joint stock companies often wielding a capital far above the reach of the most ambitious millionaire. How then to stimulate the growth of joint stock companies in India? We on this side of India have been singularly unfortunate in finding a practical solution to this problem. It is only success in business that can provoke capital, but the little Bengal has done in the way of joint stock trade is calculated to thwart rather than encourage the flow of capital. The late collapse of a well-known Banking Company has considerably thrown back the tide of joint stock enterprize. The original idea which will shortly lead, we expect, to the establishment of a Dairy had its origin in a sincere desire on the part of a few of our enterprizing countrymen to bring back the confidence of the public in joint stock undertakings, and to remove the stigma of a corrupt and selfish motives from our national character. To give practical effect to their wishes, they could not make a better and happier choice than the establishment of a Dairy Farm in Calcutta. The milk supply of the Metropolis has ever been a perennial grievance; anybody who will help in its removal will no doubt meet with the hearty approbation and gratitude of its numerous population. The prospectus of the company speaks with appropriate force on this point, and we gladly make room for a portion of it here. "The difficulty of obtaining pure milk in the Metropolis has long been seriously felt, and the public at large remain at this day as helpless in this matter as ever. The evil effects of using adulterated milk as food are more far-reaching than we can readily imagine. Not only does it daily enter into the dietary of almost every Indian household but it is indispensable to growing infants and is of utmost importance to invalids. Apart from these considerations, physicians are mostly agreed that milk is very often the medium through which many poisonous organic germs are transmitted, outbreaks of typhoid fever in London and Edinburgh having been repeatedly attributed to the adulteration of milk with infected water. The Metropolitan Dairy Company will spare no pains in meeting this long felt evil. The projectors further hope that their undertaking will give rise to healthy rivalry in the community and will lead to an early improvement in the milk trade of the Town."

Why should we even go so far as London and Edinburgh to look for precedents. Even among ourselves in this Metropolis, this indispensable article of human food, to which the nation mainly looks for its health and nutrition, is openly playing its fatal death game. The Municipality has long since recognized this standing eivil, but despite its exertions, the milk trade of Calcutta still retains most of its ancient abuses. The reader will find much interesting information on the subject in Dr. Macleod's lecture delivered before the Dalhousie Institute in 1886 and subsequetly published by the Health Society of Calcutta. The squalid surroundings and the conglomeration of filth in an town cowshed are some of the most repulsive sights that can be conceived. Sir Henry Harrison has pronounced the cowsheds of Calcutta as the most obtrusive nuisance of the Metropolis, and Dr. Macleod considers the milk question among the very foremost sanitary problems of the future. Under such circumstances the public will not fail to congratulate the Metropolitan Dairy Company on its singularly happy idea to help in removing a long standing source of infection. It is a matter of great satisfaction that the Company includes among its members some of the most prominent persons of our community The company proposes to start with a capital of Rs. 10000 to be raised in a hundred shares of Rs. 100 each. We appreciate the dictate of common prudence which has led the company to begin its operations on a small scale, and not to court failure by implicating itself in bolder speculations. For we should be at all times alive to the fact that any failure of joint stock enterprize will only serve to aggravate the distrust of the public and thus retard the progress of the good cause. We have been requested by Baboo Bhupal Chandra Basu, the Managing Secretary of the Company, to state that he would gladly supply our readers with any information they may want in connection with the Company. Finally we bestow our sincere congratulations on the company, and wish it god-speed.

NEWS.

Prospects of the Cotton Crop in the Bombay Presidency.

The report up to the end of January 1887 is as follows

GUZERAT

Ahmedabad.—The area under cotton is about 283,000 acres or 10 per cent. below last year and 11 per cent. above average. The chief cotton-growing talukas are Viramgam, Dandhuka, Dholka and Sanand. Compared with last year there is an increase in area in Viramgam and Sanand, but this increase was outweighed by a very large decrease in the Bhal tracts (Dhandhuka and Dholka) where owing to excessive moisture early in the monsoon, sowing was much retarded. The long break in the

rainfall in September was very trying to the plants. But the fall in October was everywhere opportune and was especially favourable in Dhandhuka, Viramgam and Sanand. Frosty and cloudy weather in January was more or less injurious to cotton throughout the district. The injury was slight in Viramgam but was very great in Dhandhuka, where there was also a slight fall of rain on the 12th January. The yield is estimated at 12 annas in Viramgam, 10 in Dholka and 8 in Dhandhuka. The whole outturn is estimated at 60, 300 bales. Except in parts of Gogo the crop has not yet been picked, so that there is no trade going on in new cotton.

Broach.—The area is about 213,600 acres, that is 1 per cent. above average, but about 12 per cent. below last year. Cotton is grown all over the district. Compared with last year the decrease in area in Vagra and Amod is slight, but in Jambusar where the rainfall last year was not very heavy it is very great. The rain did not become general this year till after the middle of June, when a good and general fall was followed by a break, at a time most opportune for sowing. Rain then recommenced and continued favourably till the middle of July when, except in Hansot, it became excessive, and in many places washed the seed out of the ground. The break in the last week of that month was very opportune, except in Jambusar, and the land which had been damaged as above mentioned was re-sown. In Amod and Jambusar the rainfall about the middle of August was again excessive, and the second sowings were in turn washed out, necessitating a third sowing during the break which luckily took place at the close of the month. In the low-lying parts of Vagra the crop was washed away by excessive rain early in September. The fall was sufficient, on the other hand, to cover the long break at the end of that month. The light showers early in October were very opportune especially in Jambusar. About the middle of that month the fall was injurious, especially in the Broach taluka. The break in the last week of October was very favourable in Amod, but the warm, cloudy weather which followed at intervals brought on a disease called "Chasia," causing a white coating over the leaves and retarding the growth of the plants. This disease has been stopped by the cold weather in Amod and Broach, though it lingers in Ankleshwar. The plants have everywhere borne pods which in some parts of the district have begun to open. In Amod the season will be from 15 days to a month behind hand. Injury from frost on the 6th and 7th February is reported from Jambusar, especially in *gordú* soil. Here the yield is estimated at not more than 2 annas. In the other talukas the estimated yield is said to vary from 6 annas in Broach to 12 annas in Vagra. The estimated outturn is 34,000 bales. There is as yet no trade in new cotton.

Surat.—The area is about 101,000 acres, that is, 8 per cent. above last year and about 23 per cent. above the average of the last seven years. The chief cotton-growing talukas are Olpad and Bardoli. In the three southern talukas of Chikli, Bulsar and Pardi scarcely any cotton is grown. In many parts, the continuous fall of rain which lasted for about a month between the 24th June and the 24th July retarded cotton-sowing and washed away the seeds sown at intervals during that period. In the beginning of August there was a break with light showers, favourable for completion of sowing and for re-sowing fields flooded by the heavy rain of July. Heavy rain from the 16th of that month was slightly injurious in Olpad to the newly-sown seed, so that on a favourable break occurring at the end of the month, some of the land was sown again. The long break in September was injurious in Olpad and Bardoli, but in October the crops were revived by a favourable fall. In the latter taluka the cloudy weather in November was somewhat injurious. The "Chasia" disease has caused some injury in Olpad and Chorasi as in Broach. The plants have begun to fruit. In Bardoli the season appears to be very late. The anna yield is not fully reported.

Kaira.—Area 10,664 acres, that is, 4 per cent. above last year, and about 56 per cent. more than average. Kaira is not a cotton district. The largest area under cotton is in Anand, and the smallest in Kapadvanj. In Anand the season was not favourable. The rainfall was too light in the beginning and too heavy at the end of the season. There was also injury from frost and from cloudy weather. The yield varies from 3 to 9 annas. Estimated outturn is 1,150 bales.

Panch Mahals.—Area only 795 acres or about 200 acres more than last year. Nearly the whole of this area is in Halol. In Dohad and Jhalod cotton is not grown at all. In Halol the crop is middling and is estimated at 8 annas.

KARNATAK.

Dharwar.—Area about 487,880 acres, that is, 5 per cent. above last year and 25 per cent. above average. Of this about two-thirds is under indigenous or Kumta cotton and the remaining one-third under exotic or Dharwar-American cotton. The largest area under the former is in Navalgund and under the latter in Gadag and Ron. In the western talukas, Hangal, Kod and Kalghatgi scarce-

ly any is grown. The deficient rainfall in August retarded cotton-sowing in many parts—especially in Bankapur and Karajgi. The rainfall at the beginning of September was heavy in parts but fell off towards the close of the month, and on the whole was sufficient and favourable except in Ron. The season was, generally speaking, favourable, and this accounts for the increase in area over last year. The north-east wind in December and January brought on blight to the exotic cotton in Hubli, Gadag, Navalgund, Ron and Bankapur. The indigenous cotton is generally good, and nearly up to average except in Navalgund where it also is partially blighted. The average yield for the whole district is 9 annas for indigenous and five annas for exotic. Estimated outturn is 54,900 bales.

Bijapur.—Area about 410,000 acres or about 2½ times that of last year and 55 per cent. above average. The area this year is unusually large everywhere owing to favourable rains. Cotton-sowing began with good rain about the middle of August and was completed by the middle of October. In Indi and Hungund the rainfall in June was less favourable than elsewhere. There was also some damage done by locusts and grasshoppers to early sown *jowari*, and the deficiency of the July rainfall retarded re-sowings of this crop in many places. This and the favourable rainfall for cotton in August encouraged the cultivators to devote more land to cotton—both indigenous and exotic. The area under the latter is 33,000 acres of which nearly the whole is in Hungund. The crop was blighted everywhere owing to the north-east wind and cloudy weather. The yield is said to vary from 4 to 8 annas of indigenous cotton and 2 to 8 annas of exotic cotton. Estimated outturn is 29,010 bales.

Belgaum.—Area about 189,700 acres, that is, about 51 per cent. more than the average and 32 per cent. above last year. Athni, Parasgad and Gokak are the chief cotton-growing talukas. In Khanapur the area is insignificant. The bulk of the cotton is what is known in Bombay as Kumta cotton. There are about 850 acres under exotic cotton or Dharwar-American, all of which is in Parasgad. Compared with last year the area in Athni has more than doubled. Here the July rain was deficient and the August rainfall (favourable for cotton-sowing) was most seasonable. There was, on the other hand, decrease in Chikodi where owing to timely rains the land which would otherwise have been reserved for cotton and other rabi crops was sown with jowari. The cotton plants were at first healthy and vigorous, but since they first began flowering, the north-east wind has set in and caused blight in parts of Athni, Parasgad, Gokak and Sampgaon. In the Belgaum taluka the yield is estimated at 12 annas; in other talukas it varies from 4 to 8 annas. In Parasgad the yield of the exotic crop is estimated at 2 annas. The estimated outturn is 10,900 bales of which about 10 are of exotic cotton. There has been as yet no trade in new cotton.

SIND.

Hyderabad.—Area roughly estimated at 55,000 acres, or 3 per cent. below last year, but 30 per cent. above average. Injury from frost in January is reported from several talukas.

Shikarpur.—The area is 9,500 acres. Crop on the whole somewhat poor and below the average owing to insufficient water-supply and rainfall. Yield 10 annas.

Upper Sind Frontier.—Area 2,300 acres. Condition in the chief talukas poor and below average owing to damage done by bollworms and excessive moisture.

Thar and Parkar.—Estimated figures are 3,500 acres. Crop good.

Karachi.—Area 1,037 acres. Condition fair.

Khairpur.—Area about 2,800 acres. Crop in places poor. Yield is 9 annas.

GUJERAT STATES.

Baroda.—Area 400,000 acres, that is, 4 per cent. less than last year. The area figures for Native States are not more than approximately correct. Condition and prospects about the same as in the neighbouring British districts. The yield is reported to vary from 8 to 10 annas.

Kathiawar.—Area 1,675,000 acres, or 5 per cent. less than last year; Jhalawad has 375,000 acres; Halar 400,000 acres; Gohilwad 525,000 acres; and Sorath 375,000 acres. The decrease is general and is due to excessive rainfall in the beginning of the season, which in Halar destroyed the crops newly sown, so that the land had to be re-sown with some other crop. Crop on the whole fair.

Cutch.—Area 187,000 acres or 2 per cent. less than last year. The decrease is due to rainfall being seasonable for other crops. Injury from frost is reported. The estimated yield is 10 annas.

Other Guzerat States.—103,672 acres or 21,125 acres less than last year. Palhanpur has 67,000 acres less, Rewakantha has 28,000 acres. The remainder is in the States of the Mahikantha in Cambay and the Surat States. Frost reported from Cambay; yield 8 annas; in Mahikantha the crop is good; yield 12 annas. In most of the Rewakantha States yield is from 4 to 8 annas.

SOUTHERN MARATHA STATES.

Kolhapur.—Area 34,000 acres, that is, 14 per cent. more than last year. Kathkol, Raibag, and Shirhol are the three chief cotton-growing subdivisions. In the first two the increase is due to timely rainfall. Crop is in places blighted. Yield 12 annas in Kathkol and 5 annas in Raibag.

Other Southern Mahratta States.—Area 211,744 acres made up of 51,000 acres in Sangli, 29,000 acres in Miraj (both Senior and Junior), 68,000 acres in Jamkhandi, 36,000 acres in Mudhol and 26,000 acres in Kurandwad, Ramdurg, and Savanur. The crop has been blighted more or less everywhere. In Sangli the plants are stunted and the pods small.

B.Sc. in Agriculture.—To the Edinburgh University Council, which met on Monday, (January 31st) it was reported that the Chancellor of the University had sanctioned, in terms of section xii. 2 of the Universities (Scotland) Act, 1858, the regulations adopted at last meeting for granting the degree of Bachelor of Science in the Department of Agriculture. It was ordered that the extract minute of the Court of date 15th November 1886, containing the regulations, with the Chancellor's sanction appended thereto, should be transmitted to the Senatus for preservation. In connection with graduation in the Department of Agriculture, it was resolved, on considaration of a minute of Senatus to recognise the Royal Agricultural College of Cirencester, and the Agricultural College, Downton, in terms of section i. 3, of the Regulations for Graduation in Science; and to consider courses of agricultural chemistry by recognised extra-academical teachers of chemistry as qualifying for the second examination in the said department.

Keeping Potatoes from Rotting.—If potatoes are wet when dug, as they are apt to be late in the season, a little fresh lime scattered over the heap as they are put into the cellar will dry them. Do not put in deep bins, or even barrels at first, as this will confine moisture where there is no circulation of air to dry it out.

Plum Pudding.—For a good plum pudding take 1 lb. of sifted flour, 1 lb. of bread crumbs, a pound each of raisins (stoned) sulfanas, currants, ½ lb. of mixed peel, chopped fine, 2 ounces of sweet almonds, minced, one lemon (peel and juice); mix with ten eggs lightly beaten. If not enough of moisture add a little milk. Boil at least eight hours.

Agricultural Education.—Education would assist farmers, but it was a standing disgrace to our country that the Government practically ignored it, as applied to our most ancient industry. In France, and in other countries, agricultural colleges and working farm schools were common, and at these schools thousands of youngmen were trained in the practice and science of agriculture, for the smallest of fees. In England, however, the young farmer of the future was sent to a commercial school, where he scarcely ever heard the word "agriculture mentioned, unless his parents were in such a position as to afford to educate him at the Royal Agricultural College, where he could obtain knowledge which would stand him in great stead in after life. Farmers who had not been educated in the science of agriculture were often alarmingly deficient in their knowledge of the names and qualities of grasses, of the comparative value of foods as applied to the formation of rations for stock and of the characteristics of manures. It was common to hear some gentlemen remark that a particular manure or a particular plant exhausted or "drew" the land—a result which practically we all required them to do, for manures were cheaper than crops and fertility was easily replaced. There were few who appreciated the fact that the fertility of the soil was in proportion to its smallest constituent, and that "drawing" the land was merely extracting stored-up fertility generally as regards one particular constituent, which the tenant pays his rent to obtain. The speaker explained these two points more fully, and likened land to a child which is fed and thrives upon new milk, and is subsequently fed and starved upon skimmed milk. The new milk contains the essential foods in proper proportions, but the skim milk does not. It was the same with the land; when its fertilising constituents were present in their proper proportions the crop was fattened, but when one was deficient it was quite unable to grow.

According to the excellent journal *Industries*, ostriches have at various times been exported from the Cape of Good Hope to India, South Australia, the River Plate, and New Zealand; and in all these cases it is said that the birds are thriving, notably so in the last-named colony, from which a first consignment of feathers was recently brought. The Cape will, therefore, no longer be able to boast of monopolising this industry.

The United States Director of the Mint, in his annual report—which is considered very trustworthy—gives the world's total production of gold for the six years ended with 1885 as follows:—In 1885, £21,100,000; in 1884, £20,600,000; in 1883, £20,200,000; in 1882, £21,300,000; in 1121, £21,500,000; and in 1880, £22,100,000.

Prospects of the Cotton Crop in the Punjab.

final report on the Cotton Crop of 1886 is as follows :—"This is the first year in which an has been made to estimate the area and under cotton in the Punjab according to plan laid down by the Government of India, comparisons therefore with acreage and yield of former years are impossible. The year has generally favourable for cotton. The area under cotton in the last three years has been—

Year.	Irrigated.	Unirrigated.	Total.
	Acres.	Acres.	Acres.
1884 ...	455,114	337,882	792,996
1885 ...	521,230	514,384	1,035,614
1886 ...	489,300	600,000	1,089,300

the acreage of 1886 has been higher than previous years, the increase being most marked in unirrigated land. Attempt has been made to estimate the outturn after ascertaining the average yield in each district. The estimate is of course only approximate. It shows the total yield of the Province to be 4 671,188 maunds of cotton. Taking ginned cotton as a fourth of unginned, the outturn is 1,167,797 maunds (or 834,140 cwt.) of pure cotton. The districts growing the largest area of cotton are Rohtak, a, Umballa, Multan, Lahore, Sialkot, Gujrat, Shahpur, Jhelum, Rawalpindi, and Dera Ghazi Khan. It is probable that the yield has not been correctly estimated in every district. It must be remembered, however, that these averages do not represent the outturn of an average year, but such an outturn corrected to show the yield of the year 1886, and this necessarily varies according to the season."

Prospects of the Burma Rice Crop.

The total area under rice cultivation in the ten surplus rice districts is now (31st January 1887) reported as 3,310,320 acres, or 18,200 acres less than last month's estimate. The estimate of the outturn then reported is confirmed except in Hanthawaddy and Pegu where it is reduced by 8,200 and 10,000 acres, respectively; Fallow area in Hanthawaddy is increased by 6,515 acres over last month's estimate. Harvest operations are everywhere well advanced and the outturn of grain is satisfactory except in part of the Bassein district. The harvest has been uninterrupted by disturbances. Estimated exportable surplus remains 1,100,000 tons.

Prospects of the Mustard Crop in Assam.

The report on the crop in the Assam Valley districts is as follows:—Area under Mustard this year is 148,443 acres as against 151,850 acres last year. The crop this year estimated at 12 annas against 14 annas last year. Exports in 1887-88 will be about 20,000 tons.

Prospects of the Ground-nut Crop in the Madras Presidency.

The following report on the sowings of the Ground nut crop has been received:—

	Districts	Total area of cultivation from April to November		Area sown from September to November	Percentage
		1885	1886		
1	Ganjam	...	...	...	...
2	Vizagapatam ...	...	...	...	...
3	Godavery ...	...	3	2	66·6
4	Kistna	...	1	1	100
5	Nellore	...	...	...	...
6	Cuddapah ...	...	123	113	91·8
7	Anantapur ...	...	378	142	37·6
8	Bellary	...	...	...	...
9	Kurnool	...	...	...	...
10	Madras	...	...	...	...
11	Chingleput ...	...	6,807	4,133	60·7
12	North Arcot ...	...	6,042	3,156	52·2
13	South Arcot ...	57,788	61,702	39,597	64·2
14	Tanjore	...	9,213	6,242	67·7
15	Trichinopoly ...	...	...	...	...
16	Madura	...	9	8	88·8
17	Tinnevelly ...	...	1	1	100
18	Coimbatore ...	...	76	61	80·3
19	Nilgiris	...	...	...	..
20	Salem	...	2,239	332	14·8
21	South canara ...	...	...	...	...
22	Malabar	...	...	...	..
	Total ...	...	86,594	53,788	62

Note—The total area of cultivation from April to November 1885 is available for the south Arcot District only

Report on the River-borne Trade of Assam for the quarter ending the 30th September 1886.—The return of trade in principal commodities with other provinces shows an increase in the total weight of articles imported, from 620,693 to 658 643 maunds, and a decrease in the weight of exports from 1,229,156 to 605,467, less than half the weight of exports in the previous year. The increase in imports occurred under the headings coal, wheat, jute, brass, *ghi*, drained sugar, and tobacco. Calcutta, Chittagong, and "other districts" imports more than in the previous year. The decrease was less marked under cotton twist and yarn, and piece-goods (European), rice, oil-seeds, and salt. The decline in the weight of exports is mainly due to a falling off in the export of rice, especially,

to the Chittagong division, owing to the unusual floods in the Surma Valley. Oil seeds also show a great and tea a considerable decrease. The decrease occurred in the trade with all blocks. Coal and cotton were the only commodities exported in in larger quantities than in 1885-86.

External trade of Bengal during quarter ending 30th September 1886.—The aggregate quantity of the trade of the Lower Provinces carried both ways during the quarter under review showed a falling off of 9,72,432 maunds, or 14·91 per cent., as compared with the total of the corresponding period of last year. The decrease was almost entirely in the imports from the North-Western Provinces and Oudh, which fell by 6,69,337 maunds, chiefly on account of smaller supplies of wheat and gram despatched to Calcutta. *Coal.*—The increase of 1,23,665 maunds, or 9·63 per cent., in the export trade is due to demands from the Rajputana-Malwa and the Bengal and North-Western Railways and the Sindhia Paper Mills in Gwalior. As usual, by far the largest quantity was despatched from the Behar block, in which the large coal mines at Kurharballi in Giridhi are situated. *Cotton, raw.*—The imports of raw cotton amounted to 64,130 maunds, against 19,852 maunds in the quarter ending the 30th September 1885. The improvement is attributed to good crop in the Upper Provinces, and fair prices and active demand in Calcutta for export by sea. The supplies drawn by Calcutta from the North-Western Provinces aggregated 34,966 maunds, against only 3,9?8 maunds in the corresponding quarter of 1885. *Wheat.*—The imports under this head showed a very large falling off of 6,56,849 maunds, or 32·47 per cent., which was mainly in the supplies despatched from Cawnpore, Ghasiabad, and Aligarh to Calcutta. The decrease is probably due to the fact that very large quantities were obtained by Calcutta in the nearer markets of Behar. *Food-grains other than wheat.*—Owing to smaller supplies of gram having been drawn from the North-Western Provinces and Oudh, the trade under this head fell to 3,16,423 maunds, which is about one third the trade of the quarter ending 30th September 1885. The decline is due to the fact that last year large quantities of gram and pulse were imported from the North-Western Provinces and Oudh into Behar and Western Bengal for local consumption, and into Calcutta for export by sea, whereas this year Calcutta drew its supply chiefly from the Behar block. *Oilseeds*—The imports, which were chiefly consigned to Calcutta, showed a considerable increase of 3,48,887 maunds, or 49·10 per cent., owing to firm home markets, high prices, favourable rates of exchange, and low railway freight. The improvement, which was almost entirely in the supplies sent to Calcutta from the North-Western Provinces and Oudh, was most apparent under poppy-seed (1,78,981 maunds), castor seed (58775 maunds) linseed (50,327 maunds), and rape seed (42,611). *Tobacco.*—In consequence of better crops and active demand this year, the quantity of tobacco exported amounted to 52,853 maunds, against only 14,497 maunds, in the corresponding quarter of the past year. The increase was almost entirely in the despatches from the Behar block to the North-Western Provinces and Oudh.

Internal trade of Bengal during quarter ending 30th September 1886.—The total weight of the internal trade of Bengal, which passed from one registration block to another within the Lower Provinces during the quarter, showed an enormous advance of 57,61,973 maunds, or 65·02 per cent., as compared with the corresponding quarter of 1885. *Down traffic.*—Good crops for which there was an active market in Calcutta and favourable prices resulted in an enormous increase in the wheat trade, which amounted to 16,50,2?8, maunds, against only 1,99,419 maunds in the year ending the 30th September, 1885. Of the entire trade, Calcutta received 16,31,526 maunds, of which Behar alone contributed 16,13,150 maunds. In consequence of plentiful harvests this year, the trade in rice showed a large increase of 3,09,352 maunds. The improvement was principally in the imports into Calcutta, which rose by 2,78,120 maunds, of which the Western Bengal block alone contributed 2,37,360 maunds. The increase of 3,89,763 maunds in the trade in gram is due to the same cause. Behar sent the largest consignments of this cereal also, despatching 3,91,833 maunds, of which 3,31,207 maunds were consigned to Calcutta. The quantity of raw jute brought downwards during the quarter under report amounted to 17,72,900 maunds, which was nearly three times the trade of the corresponding quarter of last year. It will be remembered that during nearly the whole of September 1885, through-booking of traffic on the Eastern Bengal State Railway was interrupted, consequent upon breaks on that line caused by floods, and that this caused the falling off in the trade of the quarter ending 30th September 1885. Compared, however, with the quarter ending the 30th September 1884, the traffic in this staple during the past quarter showed a trifling increase of 6·59 per cent. Owing to an active demand with good prices Calcutta market and reduced railway freight, the trade in linseed showed a large increase of 3,12,[illegible] maunds, or 30·30 per cent. The improvement was almost entirely in the trade between Behar

Calcutta. [illegible] kinds of oil-seeds is attributed to the same cause. The increase of 29,252 maunds in the trade in tobacco is ascribed to good crops and fair demand. The greatest advance was in the quantity sent to Western Bengal from the Behar block, viz., 37,271 maunds, against 14,712 maunds in the quarter ending 30th September 1885. The quantity of tea brought downwards advanced by 11,467 maunds. With the exception of 15 maunds, the whole of the above increase occurred in the imports in to Calcutta. While the supplies from the Northern Bengal block rose by 30,884 maunds, those from the Eastern Bengal block fell off by 20,116 maunds. It may be noted that previous to the 1st April 1886 the figures of the Eastern Bengal block included the imports from Assam, whereas since that date, with reference to the opening of the Dacca State Railway, that province is treated as an external block. *Up traffic,*—There was a large increase of 86,210 maunds, or 57 13 per cent., in the trade in European cotton piece-goods. The greatest improvement occurred in the despatches from Calcutta to the Northern Bengal blocks. No explanation of cause of fluctuations of traffic having been received from the Eastern Bengal State Railway authorities, the reason for the increase noticed above cannot be stated The trade in rice carried upwards showed an increase of 1,39 217 maunds, which was almost entirely due to larger exports from Western Bengal to Behar. Compared with the figures of the quarter ending the 30th September 1885, the trade in salt during the quarter under report showed an increase of 2,00,696 maunds, of which 57·42 per cent. was in the imports into the Norther Bengal block and 40·03 per cent. in those into the Behar block.

Internal trade of Bengal for the year 1885-86. The aggregate weight of the internal trade of Bengal carried by rail from one registration block to another within the Lower Provinces during the past year amounted to 4,67,55,835 maunds, against 4,40,49,887 maunds in 1884-85. The total weight of the trade increased by 27,05,948 maunds, or 6 14 per cent. Analysing the figures, block by block, the result shows an increase of 6·20 per cent. under imports and of 1·19 per cent. under imports, and an increase of 9·00 per cent. under exports in the case of Behar; an increase of 17·70 per cent. under imports, and of 8·07 per cent. under exports in the case of Western Bengal; an increase of 16·65 per cent, under imports, but a decrease of 4 32 per cent. under exports in the case of Eastern Bengal; and a trifling increase of 95 per cent. under imports, and a considerable advance of 80 79 per cent. under exports in the case of the Northern Bengal block. The net weight of the downward and upward trade during the past two years is given below:—

	Quantity		Calcutta traffic		Proportion of the Calcutta Traffic to the total trade	
	1884-85 Mds.	1885-86 Mds.	1884 85 Mds.	1885-86 Mds.	1884 85 Per cent	1885-86 Per cent
Downward traffic ...	3,30,20,313	3,57,06,838	2,94,03,062	3,12,25,717	89·04	87·45
Upward „ ...	1,10,29,574	1,10,48,997	89,83,046	90,89,768	81·44	82·26
Total ...	4,40,49,887	4,67,55,835	3,83,86,103	4,03,15,485	87·14	86·22

The different articles which showed a marked increase in the downward traffic of the past year, as compared with 1884 85, were—rice 20 91 987 maunds, linseed 8,01, 557 maunds, coal 5,41,189 maunds, and tobacco 60,284 maunds. On the other hand, the staples in which there was a large decrease were—Jute 3,14,026 maunds, other food-grains 1,81,686 maunds, gram 1,25,740 maunds, til or jinjili 1,05,642 maunds, wheat 58,276 maunds, stone and lime 52,674 maunds, and poppy 50,527 maunds. In the upward rade, the largest increase will be found in European, cotton piece-goods, 38,920 maunds (valued at Rs. 24,51,960), coal 1,01,126 maunds, and gunny-bags and cloth 50,047 maunds, and the largest decrease in rice 7,10-665 maunds salt 2,41,211 maunds, other food-grains 1,41,219 maunds, and gram 51,591 maunds.

In his General Administration Report for the past year, the Commissioner of the Burdwan Division gives the following extact from the report of the sub-divisional Officer of Raneegunge regarding the coal mines in that sub-division:—"For the first nine months of the year the trade of most, though not of all, the coal companies was certainly depressed. For the last three months of the year the demand for coal has been great, and the companies have found it difficult to obtain labour necessary to the execution of all orders received. This revival is no doubt due to the revival in the jute and cotton industries. The exports of coal for the year from the sub-division have been 598,794 tons, against 635,921 tons last year and 796,939 tons in 1883-84. Owing to the keen competition, low prices have ruled. The Commissioner of the Chota Nagpore Division writes as follows

on the mines in the Hazaribagh and Manbhoom districts:—In Hazaribagh coal mines are regularly worked at Kurharbari by (1) the East Indian Railway Company, (2) Bengal Coal Company, and (3) the Raneegunge Coal Association. In Manbhoom there are collieries, the principal of which, at Kumardubbi and Laikdi, are worked by the Burrakur and Bengal Coal Companies. The following statement shows the output of coal from the abovementioned collieries during the past two years:—

		1884-85. Tons	1885-86 Tons
Hazaribagh	East Indian railway collieries, Kurhurbari ...	266,244	311,000
	Bengal coal company's collieries, Kurhurbari	1,675,116	2,425,962
	Raneegunge coal Association collieries Kurhurbari	98,752	76,259
Manbhoom ...	Kumardubbi ...	75,728	82,175
	Laikdi ...	75,728	87,997

The external trade of Bengal during the year 1885-86.—The total weight of the external trade of with other provinces during the past two years was as follows:—

	1884 85 Mds.	1885-86 Mds.
Imports into Bengal ...	1,04,46,249	1,50,58,459
Exports from „ ...	1,05,07,718	1,31,90,238

It will be seen that the imports increased by 46,12,210 maunds, or 44·15 per cent., and the exports by 26,82 520 per cent. In the Calcutta block, the imports showed an enormous rise of 52 33 per cent., and the exports of 21 81 per cent. The import trade of the Behar block advanced by 14·18 per cent. and the export trade by 26·09 per cent. while in the Western Bengal block the figures showed an increase of 53·06 per cent., under imports and of 41·77 per cent., under exports. As regards the imports, the articles which contributed most largely to the increase in the year's traffic, as compared with that of the previous year, were—wheat, 28,01,364 maunds; gram, 16,96,429 maund; linseed, 6,34,180 maunds; raw cotton, 1,73,217 maunds; other food-grains, 1,40,620 maunds; castor seed, 1,35,205 maunds; dressed hides, 35,407 maunds; and the staples in which the decrease was most marked were—mustard seed, 5,80,713 maunds; til seed, 73,659 maunds; other oilseed, 65,910 maunds; undressed hides, 60,914 maunds, poppy seed, 52,568 maunds; indigo, 41,759 maunds; and saltpetre, 33,685 maunds. The principal items of increase in the export trade were—coal, 12,27,311 maunds; unrefined sugar, 8,92,354 maunds; gunny-bags, 1,44,951 maunds; salt, 1,32,798 maunds; European piece-goods, 72,084 maunds; tobacco, 62,432 maunds; stick-lac, 29,223 maunds; and raw jute, 32,122 maunds; while those in which there was a large falling off were—castor seed, 49,373 maunds; iron, 41,456; and other metals, 28,527 maunds.

During the year the trade in gunny-bags and cloth was steadily declining in Julpigoree, Rungpur and Dinagepore. The hand-made gunnies of Julpigoree, Bogra and Dinagepore are gradually being supplanted by mill-made bags. During the year trade in stick-lac was rather brisk in all parts of the Chotanagpur division. The exports of stick-lac were unusually great, as the outturn much exceeded that of ordinary years. The Deputy Commissioner of Manbhoom estimates the total quantity exported from his district at 60.000 maunds. The Deputy Commissioner of Hazaribagh estimates that about 25,000 maunds of lac, valued at Rs. 2,00,000, were imported from Palamow and the interior of the Hazaribagh district to Chattra, and thence exported to Chupra, Calcutta, and other places. A considerable trade in lac is also said to be carried on in Palkote in the south of Lohardugga. Most of the lac collected in Palkote finds its way to Ranchi and Lohardagga. The quantity of shell-lac exported from Manbhoom is said to have risen from 13,000 maunds in 1884-85 to 17,400 maunds in the year under report.

Although considerable doubts were at first thrown on the discovery of kaolin or china clay at Whitefield in the Madras Presidency, all doubt is now dispelled. Messrs. Arbuthnot & Co., have taken a lease of the property, having entered into a contract with the Telegraph Department for the supply of insulators. They have also engaged a trained potter from Bombay, who has alread begun operations. It has been decided to remove the works from Whitefield to Avady, which is within easy reach of Madras and has good water supply. The necessary machinery and plant have been ordered from England.

A Department of Agriculture in America.—The *Times* correspondent at Philadelbhia says:—The House, by 222 votes to 26, has passed a bill creating a Department of Agriculture and Labour, whose chief will be a Cabinet Minister. The new Secretary of Agriculture is empowered to inquire into the cause of discontent between employers and employed, and may invite and hear sworn statements from both parties in such disputes. It is doubtful whether the bill will be passed by the Senate. The House has considered, without taking final action, a bill for

the suppression of pleuro-pneumonia and other contagious cattle diseases, framed by the Chicago Convention.

THE FRUIT CROP.

By Mr Charles Whitehead, F. L. S., F. G. S.

No. IV.

The American producers arrange the disposition of their produce much better and more satisfactorily than their English cousins. There is no doubt about this. And this applies especially to fruit producers who have, it goes without saying, many more advantages than those in this country in respect of cheap railways and steamship rates, and remarkably good, direct, and rapid services. For the more perishable fruits. refrigerators are provided, so that, for example, strawberries are sent from Florida to New York as fresh as those sent from the Crays, in Kent, to Covent Garden. Growers in Florida begin to send strawberries to New York about the 1st of February. Then comes a supply from North Carolina and then from Charlestown, delivered at a cost by rail and steamship in capital order, packed in the quart baskets in which they are picked, arranged in separate tiers in large well-ventilated crates holding about 30 baskets. If the American fruit growers cannot sell their raw fruit at a profit they are not disposed to let it be wasted if they can possibly help it. There had been occasionally, in fruitful years, a great waste of peaches, pigs actually being fed upon this fruit. Apples also were now and then used as food for swine. Jam-making was out of the question in America; at least upon anything like a wholesale scale, because of the dearness of sugar, so the fruit growers set themselves to devise other means of disposing of their surplus fruit. For this purpose enterprising persons erected large establishments, furnished with the most improved machinery for the rapid drying and evaporation of the watery parts of the fruits. By an ingenious process the water is slowly separted from the solid parts, which, at the same time, undergo a chemical change, the acid and the sugar being converted into grape sugar. Fruit thus treated will keep for a long time, and the process is so satisfactory that the Commissioner of Agriculture for the United States reports that this fruit "cannot be distinguished, when cooked, from fresh fruit, and actually requires only one-half the quantity of sugar to sweeten it." Fruit in this from is largely used in the United States, and is exported extensively to other countries. Not only are there these large factories for fruit drying in the principal cities and important towns but very many of the growers are provided with portable iron stoves and small apparatus constructed on the principle described above for drying fruit which they cannot sell at a paying price. Even the smallest growers have little stoves of this kind for the purpose and whole family is employed in slicing and coring apples or quartering peaches or preparing soft fruits, previous to the process of drying.

These apple slices, or chips, peach quarters, and other fruits either are exported, or are kept for home consumption, without any sugar being used in their preservation. A considerable quantity of fruit also is pulped or boiled down, or steamed down, without sugar, and put into air-tight vessels to be kept until a demand arises at home or abroad. So the Americans with their proverbial sagacity have devised means of utilising and conserving their surplus fruit though they are cut off from making it into jam. That these means are efficacious and widely adopted is shown by the fact that in the last year, 1885, no less than 1,860 968lbs. of fruit preserved without sugar were imported into Great Britain from the United States, together with 10,559 cwts. of dried fruit.

The Canadians, who are large producers of apples which closely compete with our own in colour, quality, and flavour, have establishments for drying those apples which cannot be profitably sold as raw fruit. These are perfectly dried and packed in 50 lb. boxes for exportation or home consumption.

With sugar at something under 1½d. per lb. the English fruit-growers might have enormous advantages over the American fruit-growers, if they chose to manipulate their surplus fruit themselves as the latter are accustomed to do. And not only would they have advantages over Americans, but also over the fruit-growers of every other country in respect of the manufacture of jam, that is, fruit preserved with sugar, seeing that sugar is from 100 to 180 per cent. cheaper in England than in other countries. If they cannot manipulate their fruit themselves they should combine to establish jam factories, as the fruit-drying factories have been established in America and Canada, to which their fruit may be consigned if they cannot dispose of at fair prices.

But a large fruit-grower should have his own jam-making or fruit-pulping apparatus. It is not costly, it is not expensive to work. It is not a mysterious or difficult process, that of jam-making. The most ordinary house wife can make jam better than the production of half the jam-makers. Her copper vessel only requires to be magnified according to circumstances, and, perhaps, heated by steam instead of by direct fire heat. The after processes are merely extentions of the system extent in every country kitchen. This is the most economical, system, namely, the conversion of fruit into jam, or

into pulp, upon the spot where it is produced. There are many fruit growers who have from 80 to 130 acres of fruit land. Surely it would pay such over and over again to take a leaf out of the American book, and in a true commercial spirit to prepare their produce in the form best calculated to sell it to advantage. It is held that it would pay these, and not only these, but also much smaller producers.

If, however, the producers are unenterprising and indifferent, and say, as it is felt, they will say, that it is not their business to go into such details, the next best system in point of economical advantage is to send the fruit to a factory established upon the joint stock principle by associations of fruitgrowers who would thus get an outlet for their fruit and their share of profits made by the concern. Against this, it must be pointed out, there are the risks of careless management and the absence of the direct and active stimulus which spurs on the individual.

As has been shown before, the methods at present in vogue concerning the disposition of fruit by its producers are wasteful and wrong from an economic point of view. If any further illustrations of this were necessary it can be furnished now that jam-manufacture is upon the *tapis*, by a statement of the probable profits made by jammakers. At the prices which have been paid to the growers for fruit in this last season and at the low rates at which sugar could be bought, jam has been made at an average cost of about 3½d per lb., excepting strawberry jam, as strawberries were not extremely abundant and their prices were comparatively high. The present price charged for jams of various descriptions ranges from 4½d to 7d per lb., showing a fair margin of profit at the lowest quotations, and an excessively good one at the higher rates. When fruit is not plentiful the price of jam is quickly raised, but it is never lowered down to the minimum point justified by the circumstances and cost of production and manufacture. As in the case of fish, meat, bread, and other commodities whose supply, or the supply of whose component parts, is abundant, the consumers of jam never get the full and fair advantage of the plentifulness and cheapness of fruit There is a profit to be made out of jam, and the fruit growers may just as well share this among themselves.

Whether the growers take up jam manufacture individually, or whether associations of growers or of capitalists are formed for this purpose, they will of course adopt the system practised in America and other countries as well as by some jammanufacturing firms in this country, of simply pulping the fruit and keeping it without sugar until a favourable opportunity presents itself for making it into jam. There is also a method of drying fruit by what is known as the Alden process which might be adopted for drying plums and damsons when they are superabundant. This would be better than letting the fruit rot upon the trees, as in this season.

In conclusion it must again be strongly urged that fruit-growers should not despair because circumstances have worked together against them in respect of this year's crop. There are many reforms which it is in thier own power to effect. There are many methods which they can perfectly well adopt if they please. It is fully believed that if these reforms are brought about and these methods adopted, fruit-growing will continue to be a profitable branch of agriculture.—*The Mark Lane Express.*

CULTIVATION OF TOBACCO.

(From the Agricultural Gazette.)

Some few years ago, when proceeding to India, it was suggested to me that I should take out with me some tobacco seed, and a friend kindly procured me several samples. My destination in India was the Kangra Valley in the North of the Punjab, about 4,000 feet above the sea level, where I lived for some time with a friend on one of the tea estates for which the valley is famous.

On enquiry, I found that the natives only grew tobacco in a rough and ready manner for use in the hookah. For this purpose the plant is allowed to run up and flower, and when the seed is ripe, it is cut-down, dried, and then pounded, leaves, stem, and seeds, together with spices and coarse sugar, or, in the case of wealthy natives, with confection of roses. I found also, being a smoker myself, that it was exceedingly difficult to procure good tobacco for my own use, that sold by the Parsee merchants being generally of poor quality, and in wretched condition. All this encouraged my friend and myself to become the pioneers of tobacco-growing in that part of India. We entered into communication with the head of the Agricultural Department at Lahore, and from him received much useful advice and assistance, together with a supply of acclimatised seed chiefly Virginian.

Our first experiment was made on a small scale, but though we had to contend with the difficulties of manufacturing the leaf into cakes, &c., after curing, it was so far successful that I decided on cultivating more largely on my own account, my friend being unable, owing to his occupation on the tea estate, to do more than grow a little for his own use My plan was to sow early in well prepared seed beds, which were covered with thatched hurdles to protect the young plants from frost at night. The beds, were kept weeded and the young plants treated very much as you would treat cabbage plants in a seed bed. The land for the subsequent reception of the plants was well prepared by deep trenching and manuring,

using a large amount of wood ashes, this being one of the most valuable manures for tobacco ; in fact, every bit of grass, weed, trimmings from hedges, &c., was burnt and incorporated with the soil, in addition to a large quantity of ashes collected from the village.

In choosing the land to be planted, care was taken to select fields that were well sheltered by high hedges from strong winds, which are most hurtful to the plants when they have attained a large size. The land having been lined out, and the position of the plants and paths decided on, the work of planting commenced as soon as the danger of night frosts was over. Each man or boy was provided with a basket of young plants, kept covered to protect them from the direct rays of the sun, and a trowel. A nice comfortable little bed was made for each plant by loosening the soil and beating the lumps fine, and then the young plant was put in and the earth firmly pressed round the roots. Behind every second or third planter came a boy with a water-can to give the young plants a good soaking. In some instances it was necessary to protect the young plants from the direct rays of the sun by means of pieces of banana leaf stuck on end.

As soon as the plants had grown to six or seven leaves they were topped, and from that time on were examined daily, and every sucker and sprout taken off, so as to throw all the goodness of the plant into the leaves. They were also liberally supplied with weak manure water made by soaking sheep or goat's droppings in large earthen vessels with water, and diluting the liquid as required. In this way the plants grow to an astonishing size, the leaves often measuring a yard or more in length. As soon as the leaf was ripe (*i e*, as soon as slight yellow patches were seen on the surface, and the leaves felt sticky when handled), the cutting commenced. A certain quantity of the best leaves were carefully picked and put aside to be cured separately as covers for the cakes (we made all our tobacco into cakes gold leaf being most in demand) ; the rest of the plants were cut down with a strong, heavy-bladed knife, and left with the stems to the sun to wilt. As soon as they were sufficiently limp to bear handling, they were taken to the curing-house, and hung, by means of bamboo rods run through the thick part of the stems, on frames to cure.

Here let me say a word of advice as to the place in which tobacco is to be cured. It is a mistake to imagine that any kind of building will do. It may be possible to cure small quantities of leaf successfully, and so as to obtain the best results, you must have a proper building.

This is particularly the case in England, where the climate is so uncertain. Tobacco gets "in case" and "out of case," *i. e.* damp and limp or dry and brittle, very easily, and it is of the greatest importance that we should have a curing-house which can be kept wet or dry, and the influence of the weather outside utilised or excluded at the will of the curer.

I recommend a house about fifty or sixty feet long divided into two rooms, with a door between. One each side of one room should have large openings, closed with louvres like the cooling room of a brewery. This is what I call the damp room, and is where the tobacco is hung first. The floor should be of cement ; the roof preferably of thatch unless there is a loft above. The walls should not be less than 14 feet high to the wall plate. Arrangements must be made for getting up a good heat quickly, so as to *fix the colour* of the leaf as soon as it has reached the desired tint.

In India we used charcoal fires, kept burning day and night, under the plants. In this country some less expensive method would, I presume, have to be adopted. The object is to keep the plants just "in case" until they have reached the desired tint, and then fix them by drying off quickly. Of course, if the weather is damp when the house is first filled sufficient moisture can be obtained by opening the louvres. If, on the country, the weather is hot and dry, the louvres must be closed, and the floor kept constantly wet. It would take up too much of your valuable space to go into the matter of bulking and doing up in bands or figs, but I shall be happy to give information to any of your readers who may be curious to know more, and also to send them a rough plan of a tobacco-house such as I have found most useful.

One word of encouragement in conclusion. We hear a good deal of the cheapness of labour in the East, and I have no doubt that some of your readers will bring this difficulty forward when reading my account of how I prepared my land and planted. But, Sir, it is to be remembered that though Cooly labour is so cheap, it is not nearly as good as English labour. One intelligent English labourer will do the work of half-a-dozen Coolies, added to which, I had to dig my land with hoes, because there were no ploughs which would penetrate six inches below the surface. I had to carry my manure in baskets, because we had no carts and no carts roads. I had to break up the clods of earth with wooden mallets, because we had no agricultural machinery. All this must be taken into consideration and then I see no reason why, in fairly good seasons and by choosing hardy varieties, tobacco of really good quality should not be grown and cured to advantage in England.—T. HENRY SMITH.

CROP AND WEATHER REPORTS.

For the week ending 2nd February 1887.

General remarks.—Except in Bengal, Assam, the North-Western Provinces and Oudh, Punjab, and Upper Burma where slight showers have occurred in a few districts the week under report has been rainless.

The reaping of the early rabi crops has commenced in Bombay and Bengal and except in the Punjab where more rain is still wanted the standing rabi crops throughout the country are generally in excellent condition and promise a good harvest, In Madras the general prospects are good but in several districts water is wanted. In Bombay standing crops have in some places been injured by blight, frost, and insects.

In Bengal the aman rice has been gathered with a good outturn, and in the districts of both Upper and Lower Burma the harvest is rapidly approaching completion.

Poppy continues to thrive in the North-Western Province and Oudh, and a fair crop is expected though in two districts the weather is unfavourable.

In Bengal, the North-Western Provinces and Oudh, and Assam the crushing of sugarcane is in progress, and in the last-named Province the mustard crop is being got in.

The public health continues generally satisfactory throughout the country.

Prices show an upward tendency in the North-Western Provinces and Oudh and are rising in most districts of the Punjab and in three States in the Rajputana Agency. In Coorg they are falling but are general stationary elsewhere.

For the week ending 9th February 1887.

General Remarks. -With the exception of light showers in Eastern Bengal the week under report has been rainless.

The early rabi crops continue to be reaped in Bombay and Bengal. Elsewhere the prospects of the standing crops are generally excellent, though some injury has been done to them by frost and blight in parts in Bombay, the North-Western Provinces and Oudh, the Central Provinces—where linseed has been principally affected—Rajputana and Central India. In the Punjab rain is still much needed for the rabi in five districts,

In Madras the standing crops are generally in good condition but in parts they have been affected by disease and in some places are withering for want of rain, In Coorg the season promises favourably,

The winter rice harvest is over in Bengal and the spring rice is being transplanted, In Burma the rice harvest is approaching completion and threshing operations have commenced,

The pressing of sugarcane is in progress in Assam, Bengal, the North-Western Provinces and Oudh and the Central Provinces, The gathering of mustard in Assam is almost over,

Poppy prospects continue excellent in the North Western Provinces and Oudh, but are less favourable in Bengal, In Central India and Rajputana the plant has been affected by frost,

The general health of the people continues satisfatory,

Prices again show an upward tendency in the North-Western Provinces and Oudh this week and are still rising in the Punjab and in some States in the Rajputana Agency, Elsewhere they remain generally steady,

For the week ending 16th February 1887

General remarks—Except in five districts of Madras where slight showers occurred, the week under report has been rainless,

The rabi early harvest continues in Bombay and Bengal and has also commenced in Hyderabad, In other provinces the prospects of the standing crops are very favourable, though injury from the prevalence of frost and blight is still reported in parts of Bombay, the North-Western Provinces and Oudh, the Central Provinces, Central India and Rajputana In the Punjab the want of rain is felt in most districts,

In Madras the standing crops have been affected by disease in three districts, and rain is generally needed, In Mysore and Coorg agricultural prospects are satisfactory,

The transplanting of the spring rice has been completed in Bengal, and ploughing for the early rice crop has commenced, In Burma the rice harvest is over and threshing is in progress, The cutting and pressing of sugarcane continues in Bengal, the Central Provinces and Assam In Bengal and Assam Mustard is being gathered,

Poppy continues to thrive in the North-Western Provinces and Oudh, but the plant is late in Bengal and has suffered from the ravages of caterpillars in the South Ganges districts, In Central India and Rajputana the plant has been affected by frost,

The public health continues generally satisfactory,

Prices are still rising in the Punjab and in some States in the Rajputana Agency, In Coorg they are falling and elsewhere are generally steady,

For the week ending 23rd February, .

General Remarks. – The week under report has been rainless. No report has been received from Burma.

The rabi harvest which continues in Bombay and Bengal has now extended to the Central Provinces, Berar and Hyderabad. The crops being gathered are wheat, gram, pulses and oilseeds. In other parts of the country the standing crops still promise well, though injury from frost and blight is is reported from places in Bombay, the North-Western Provinces and Oudh, the Central Provinces, Rajputana and Central India, and rust has also appeared, In the Punjab the prospects of the rabi are up to the average but rain is much needed throughout the Province,

In Madras rain is generally needed for the standing crops, otherwise prospects are favourable, In Mysore and Coorg the outlook is satisfactory,

The spring rice is under transplantation in Bengal, and the land is being ploughed for the early rice there as well as in Assam,

Poppy is in flower in Bengal where the collection of opium has commenced in places and in the North-Western Provinces and Oudh where the crop is in excellent condition, In Rajputana and Central India the prospects of the crop are fair though in some places it has been injured by frost,

Indigo sowings have begun in Bengal,

The public health continues satisfactory in all Provinces,

Prices are rising in the North-Western Provinces and Oudh, the Punjab, the Central Provinces and in some States in the Rajputana Agency, and are falling in Coorg, Elsewhere they are generally steady,

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Royal Jubilee exhibition, Manchester, 1887, Silk Industry Sub-Section.—Mr. T. Wardle, Chairman of the Sub-Section silk, in the Royal Jubilee Exhibition, Manchester, has addressed the following circular letter to us regarding silk :—"I am at present conducting an extensive series of investigations in the interests of sericulture, in which I should be very much pleased to obtain your kind co-operation, and you would greatly aid my honorary work if you would kindly forward me any specimens of eggs, larvæ, moths, or cocoons of silk-producing Lepidoptera found in your neighbourhood, or which you can obtain. As these entomological specimens are wanted as much for the interest of science as for those of the silk industry, I am quite as desirous to obtain specimens of those species, the cocoons of which are not at present utilised as of those which produce cocoons from which silk suitable for commerce can be obtained. In May next I intend, as Chairman (with a most influential Committee of silk Manufacturers and others) of the Silk section of the Royal Jubilee Exhibition at Manchester, to have an extensive display of objects illustrative of the silk and silk manufactures of all countries, and I shall be glad to receive any help you can kindly give me. Although it is desirable for specimens to arrive as soon as possible, it is not imperative that they should be here as early as May. All researches will be published and assistance fully acknowledged. I should prefer to have cocoons sent in which the chrysalides have not been killed, in order that the moths may emerge during the Exhibition, as all obtainable species of silkworm moths will be exhibited alive at Manchester, and I am endeavouring to get together a good collection from India especially. The importance of an extended knowledge of wild silks is very great, and I desire to repeat that it is quite as necessary to collect specimens of species producing silk which is as yet of no commercial value, as of those which produce silk of indutsrial utility. Cocoons should, in all cases, accompany preserved moths or larvæ, and the names be given if known. I enclose two circulars relating to the silk section of the Manchester Exhibition and also a few copies of some short printed directions for collecting the entomological specimens." Readers of this journal are asked to give their assistance by forwarding any specimens of silk producing moths they may obtain to the Editor of this Gazette as he is desirous of supporting Mr. Wardle in the efforts he has for sometime been making for improving the knowledge and eventually the trade of Indian silks.

* * * *

The hair test—Breeder's Gazette says. Breeders of live-stock do not, as a rule, attach as much importance to the condition of the hair of animals as they should. If they would carefully examine their animals they would find that not merely the disposition but the health can be fairly estimated by the condition and quality of the hair. This may seem strange to some, yet it is nevertheless true and well proven. If the hair is fine in texture, soft and velvety to the touch, and lays smoothly on the body, it may be safely taken for granted that the animal is fine in quality of flesh as well as breeding, and is in good health. As soon as an animal becomes sick or diseased, the hair quickly loses its lustre, the glossiness of the coat giving

way to a dull, dead appearance, while it becomes stiff, harsh and staring when the disease or disorder is of comparatively long standing. As soon as this condition is noticed first, remedies must be applied suitable to the case and at once, if you wish to save time, trouble, and possible loss. By a little practice, this matter may be reduced to something like a system, or a science, and can be applied, not merely to cattle and horses, but to swine, dogs, and other animals. In poultry, it is the "gills" or wattles and combs which are most susceptible, a dull, dingy, or ashy colour, denoting sickness of some kind which needs prompt attention.

THE UNITED STATES.—The increase of production, as shown by statistics has been marvellous in recent years. While the number of people in 1880 were more than double those of 1850, the production of the cereals not only keep pace with the population, but furnished 53 bushels for each inhabitant in place of 38 at the earlier date. With an increase of seven millions of people in the first half of the present decade, the aggregate of cereals exceeded 3,000,000,000 bushels in 1885, still keeping up the extraordinary rate of supply attained in 1885, and showing in wheat a product five times as large as in 1850, and a maize crop four times as large. The present year is one of medium productiveness, with less maize and more wheat than in 1885, promising nearly 1,700,000,000 bushels of maize, and something more than 450,000,000 bushels of wheat, a supply of the latter ample for consumption, while reserving a fourth of the whole for exportation. The other cereals have a medium rate of yield, the hay crop is ample, and the cotton product promises to be nearly as large as that of last year, six and a third to six and a half million bales. The recent extension of area and product has been remarkable. The increase of production, in this brief period, is over 43 per cent, while the enlargement of area is still greater, amounting to 54 per cent. So the advance was attained in a series of years, with a comparatively low rate of yield, including the unfavourable seasons of 1881 and 1883. The increase of wheat is seen to be more rapid than the increase of population, while the market for the surplus has declined in consequence of the better harvests of other countries, and of the increased facilities for handling the surplus of India and South America. The increase of grain growing in South America comes from a strong tendency of European emigration in that direction, and a larger use of improved implements and machines. Should it continue, competition with our grain fields will be still more severe. Accurate records of the progress and changes of production, and minor crops as well as large products, and changes in value as well, are of the first importance to rural economists, to guide in a wise distribution of crop areas, and in the introduction of new crops, to fill the gaps in consumption and reduce the areas of such crops as may have a surplus unprofitably large.

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SALE OF MR. RUSSELL SWANWICK'S PIGS.—There was a large and distinguished company at the sale of Mr. Russell Swanwick's Berkshire pigs, at the Royal Agricultural College, Cirencester. Breeders were present from all parts of the country, and Continental and American buyers were also represented, most of the best young pigs being purchased for Russia. The following were the highest prices:—Lot 5, 15 gs. (the Duke of Marlborough); Lot 6, 17 gs. (Mr. Eggintoon); Lot 9, 16 gs. (Mr. Brassey); Lot 11, 10½ gs. (Lord Polwarth); Lot 12 21½ gs. (Lord Teynham); Lot 18, 24 gs. (Mr. Brassey); Lot 16, 20 gs. (Lord Teynham); Lot 25, 15 gs. (Mr. Darby); Lot 31, 23 gs. (Mr. Weletsky); Lot 33, 10 gs. (Mr. Harvey Mason); Lot 54, 15 gs. (Mr. Garne). Some of the younger animals went at lower prices, but the sale was considered excellent. The total sum realised was £825, 8s. 6d. the average being £8 10s. 2d. a head for the 96 animals sold. We simply look and wonder.

REPORT ON THE RIVER-BORNE TRADE OF ASSAM FOR THE QUARTER ENDING 31ST DECEMBER 1886. This is the seventh quarterly report that has been published, giving statistics as to the river-borne trade of the Province. The weight of the principal commodities which this Province sent out by boat and steamer to the Bengal blocks amounted to 474,619 maunds, and the imports amounted to 686,702 maunds during the quarter under report, as against 637,667 and 527,818 maunds, respectively, of the corresponding quarter of the previous year. The decline in the weight of exports is mainly due to a falling off in the export of rice in the shape of paddy from the Surma Valley, owing, to the unusual floods of 1886 in Sylhet. Oil-seeds mostly mustard, were also exported in smaller quantities; but the exports of coal and tea largely increased. The increase in the imports is mostly due to larger quantities of rice having been imported into the Surma Valley, the natural consequence of the decline in the export of paddy. There were also small increases in salt, sugar (undrained), iron, and other metals, counterbalanced by decreases in gram, coal, cotton goods, and a few other articles. Eastern Bengal, Calcutta, and Chittagong imported more than in the corresponding quarter of the previous year.

RETURNS OF RAILWAY BORNE TRAFFIC OF THE CENTRAL PROVINCES FOR THE QUARTER ENDING 31st DECEMBER 1886.—The total traffic of the quarter amounted to 33,83,406 maunds, and was less than that of the corresponding quarter of 1885 by nearly 6 lakhs of maunds. Traffic decreased most largely in the Jabalpur, Narbada, and Nagpur blocks, and the decrease was relatively highest in Jabalpur, amounting to 31 per cent. *Imports.*—The chief imports are Coal, Cotton twist and yarn, Cotton piece-goods, Juar and Bajra, Jute—gunny bags and cloth, Metals, Salt and Sugar. The total import traffic amounted to 8,62,975 against 6,99,332 maunds in 1885, the increase was mainly due to the larger quantities of *salt* received from the Bombay Presidency by the Jabalpur and Nagpur blocks and to a small increase under *metals* This latter increase occurred in the Nagpur block which imported 30,589 maunds of iron from Bombay against only 15,529 maunds in the corresponding quarter of 1885. There was also an increase in the imports of *Juar* into the Nagpur block from the Berars. A similar increase occurred during the preceding quarter which was caused by the apprehended failure of the rice crop in Bhandara and Balaghat. This traffic was believed to have ceased after the timely rain which fell in October, but the present returns go to show that it continued during the quarter ending December 31st. This may be set down to the fact that the Juari crop in the Berars was an exceptionally good one for which better prices could be obtained in the Nagpur and Bhandara districts than locally. The decrease under *Coal* occurred in the Jabalpur block, which imported only 53,437 maunds against 82 602 maunds in 1885. The decrease under *Cotton piece goods* was chiefly owing to the smaller imports of European goods, which fell from 42,225 to 20,805 maunds. *Exports.*—The principal items in the export trade are Coal, Cotton, Wheat, Rice, Gram, Linseed and Tilseed. The most noticeable feature in the export trade is the large increase under cotton. The exports were almost wholly, from the Nagpur and Wardha districts, where the season was favourable and the crop turned out very well. The decrease under *grain* and especially under *rice*, was to be expected owing to the character of the monsoon rain-fall, which proved very disastrous to the crop. The decrease was greatest in Nagpur and Chhattisgarh, amounting to 88 per cent in the former and to 89 per cent in the latter, In addition to this decrease in export the Province received in imports 57,801 maunds against only 597 maunds in the corresponding quarter of 1885. The season has on the whole been favourable to wheat, and the smallness of the exports was no doubt caused by the rise in price which took place owing to the partial failure of the rice crop. The greatest fall occurred in the Jabalpur block, while in Narbada the figures remained almost stationary From Chhattisgarh curiously enough the exports of wheat rose from 88,315 to 1,07,230 maunds The greatest failure in rice occurred in this Division and traders would appear to have held back their stocks of wheat during the previous quarter in the hope of getting high prices, until the timely fall of rain in October dispelled all apprehensions of great scarcity, and exports recommenced with more than ordinary briskness The large falling off in the exports of *linseed* was due to the shortness of last year's crop. Over a large portion of the Province the linseed crop was a total failure.

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RETURNS OF RAIL-BORNE TRAFFIC OF THE PUNJAB FOR THE QUARTER ENDING 31ST DECEMBER 1886. The trade of the province shows a further falling off in both imports and exports when compared with the returns of the quarter ending 31st December 1885. The total imports for the present quarter amount to 1,151,013 maunds as compared with 1,306,831 maunds during the same quarter last year. The decrease has occurred chiefly under the heads coal, European cotton piece-goods, rice, iron, and drained sugar. On the other hand the import of salt (chiefly from Rájputána) has more than doubled, and that of undrained sugar has very considerably increased. This item, however, is not an import, from beyond the seas, but only from one part of British India to another. The exports have fallen out of all proportion to the imports, from 7,574,107 maund during the same quarter last year, to 1,578,561 maunds during the quarter under report. A very large proportion of this falling off is on account of wheat, which from the Karachi port alone has fallen from 4,065,392 maunds to 146,256 maunds. The exports of gram have risen by 50,000 maunds, though they have somewhat declined since the last quarter reported on. The export of undrained sugar to Rajputana has increased. It seems, however that the province does not produce sufficient sugar for its requirements, importing more than it exports. The exports of rice, other grains, and mustard seed have also greatly declined, though it is noticeable that Karachi exports somewhat more mustard seed than she did a year ago.

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GARDENING—The operation of layering consists in bending down a shoot that is near enough to the earth, and burying a portion. It should be bent in such a manner that the growing point stands out as if coming from a root, while the other end is attached to the parent plant. It is best to first strip off the leaves of that part which is to go below the soil.

Then, by means of a sharp knife, make a long upward cut half way through the shoot. This will leave a sort of tongue in the shoot when bent, on which, when placed below the soil, first a callous will form, and very soon a mass of fine roots. When this rooting has taken place, or along towards the fall, the layer may be severed from the parent stool, and taken up. It will then be an independent plant ready to do duty; if a rose, for example, as a pot-plant, or if a shrub, ready to set out wherever a new plant is needed. A number of greenhouse or flowering plants may be readily increased in this way, and those who find raising plants from cuttings somewhat difficult, may try this plan. Budding consists in inserting buds of one tree into the bark of another. It is important to the nurseryman, as by it he can readily prepare choice varieties of ornamental or fruit trees, by taking a single eye or bud from a scarce or valuable kind, and inserting it into any other variety of the same species. Thus for every eye he secures a new plant, with the full vigour of the stock on which the eye is worked. It is not confined alone to budding on wild stock. The nurseryman finds that, in certain instances, a particular kind of tree or shrub will do better worked on another, which perhaps has previously been worked on a wild stock. Grafting and budding differ in that the former, as a rule, is done when the tree is at rest, while the latter is performed during the growing season. The proper time for budding may be ascertained from the growth of the stock or piece on which the bud is to be inserted. Its longitudinal growth should be nearly completed, and its wood-forming process most active, so the bark will part freely from the wood. The buds on the scions must be well filled out. Usually a bud is better dormant the first winter, and just before growth starts in the spring, the stock is cut immediately above it thus throwing the whole force of growth into the shoot from the new bud. The operator will require a sharp knife and some tying material. The stock near the part to be budded is first denuded of side shoots or leaves, and a T shaped incision made through its bark. The bud, the leaf having been detached, is cut from the scion, the knife being entered say half an inch above the bud, and drawn downward about one-third the diameter of the scion, and brought out at an equal distance below; this makes the shield or bud. By the old-fashioned method the wood at the back of the bud was removed, a very delicate operation to perform without injuring the bud. What is called the American method obviates this difficulty. By this the shield, or bud, is cut somewhat thinner and inserted, wood and all, into the stock. The bud being ready, the bark is slightly raised at the incision in the stock, either by means of the end of the knife, or what is usual among experts, by the insertion of the bud itself; the bud is tied in, and the work is done. In about a couple of weeks the ties must be removed, if the stock is growing freely; if not, it may remain longer. This may be known by the ligature beginning to cut into the stock. Sometimes a second somewhat looser tying is necessary, but this can readily be ascertained by inspection.

* * *

COTTON GIN OF CHINA—The port of Ningpo like that of Shanghai, is situate in a cotton-producing country. About a moiety of the crop grown on the southern shore of the Hangchow Bay finds its exit here in native craft bound for Formosa, where it is exchanged for sugar, turmeric, linen, cloth, dried fish and medicines, that are in demand in China. The remainder, as well as that grown in the districts to the south of it, is ginned, scutched with the bow, spun, and woven into cloth in the homes of the people. The ginning machine, to be found in every decent household, has two cylinders, 10 inches in length. The upper, an inch in diameter, of smooth iron, is worked by a pedal and crank. To the further end of it a narrow board is attached by its middle. The ends are weighted, so that it acts like a fly-wheel. The lower cylinder is slightly over 2 inches, and made of Mao-lieh wood, unsmoothed. This is a common tree, the leaf resembles that of an elm. Its peculiar surface catches the cotton fibres, while the proximity of the upper cylinder prevents the seeds accompanying them. The lower cylinder is turned by one of the hands of the woman sitting at the machine, while she feeds with the other. The Japanese one, lately introduced, is worked with one pedal by a man standing and requires his full weight. The frame is of cast iron, as is the fly-wheel. The principle is a wooden cylinder, 15 inches long covered with tanned leather scored diagonally, working against a smooth metal edge. The fibres are caught by the lips of the cuts and are drwn through the crevice, leaving the seeds stripped. The operative with both hands, supplies the feeder, which consists of prodding bars, between which the naked seeds fall. In some family residences the scutcher's bow, mallet, and bed, and the weaver's loom are to be found, and men (or women) who are skilled in their use. Scutchers and weavers, with their respective apparatus, can always be had for a wage of 16c. (about 7d.), and two meals a day. If machinists can furnish improvements on these simple contrivances at a low cost, an extensive market is open for their inventions. By the indifference that has attended the introduction of the Japanese machine,

that does the same amount of work that 10 or 12 native ones could scarcely do, it may be argued there exists no prejudice against innovation to offend.

* * *

THE INDIAN WHEAT TRADE.—The exports of wheat exceeded one million tons (21,060, 519 cwts.), a larger quantity than had been exported in any previous year. Down to 1870-71 the trade may be said not to have existed, for until then wheat had to be carried round the Cape, and the high freight as well as the damage done by weevil in a voyage of three or four months made export unprofitable. In 1870-71 the opening of the Suez Canal shortened the voyage to five weeks and made a trade possible, but business was impeded by an export duty of three annas on every maund exported and development was slow until the duty was repealed in January, 1873. During the year following that repeal the exports increased more than fourfold. They fell off in 1874-75 when prices rose in India, owing to the famine in Behar, and at the same time fell in England, but thereafter the trade rose in three years from 2½ million hundredweight in 1875-76 to 6¼ million in 1877-78. In the two succeeding years of famine and high prices in India exports declined to a very low point, but, with a return of good harvests and a fall of prices in 1880-81, the shipments of that year reached about 7½ million hundredweight. In the following year, 1881-82, they reached near 20 million hundredweight, the sudden expansion being due to very bad crops in the United States and the action of speculators who corner wheat, hoping to make immense profits from the rise in price. The deficiency in the supply was, however, made up by the exports from India and elsewhere, and with larger supplies our exports fell to 14 million hundredweight in 1882-83. In the following year they rose again to nearly 21 million hundredweight, then fell again to less than 16 million, the cultivators preferring to store their wheat rather than accept the low prices offered, and last year shows a recovery to 21 million hundredweight, or about 0-5 per cent in excess of the trade of two years ago. The trade may be said to have commenced in 1873-74, and to have gone on increasing after the cessation of the famine period in 1879-80, with increased railway mileage, increased irrigation, reduced rates of railway and sea-freight, reduced cost of handling at the Indian ports, and good seasons during the last six years. It has been helped by the action of speculators who had an imperfect knowledge of the capacity of India to fill the vacuum they had created, and also by bad harvests and a yearly diminishing acreage under wheat in the United Kingdom. The trade has been maintained under these favouring conditions in spite of the persistent fall in prices in the European markets, a fall only partially covered by the fall in exchange.

* * *

DEVELOPMENT OF INDIA.—At a meeting of officers and gentlemen interested in the affairs of the British Empire in the East, held lately under the auspices of the East India Association at the Westminster Palace Hotel, to consider proposals for the development of India, Earl Granville presided, and a paper was read by Mr. Jeans, entitled "How to Develop India." He argued that the curtailment of the expenditure on the construction of new railways in India was little short of a national disaster. The traffic that had so far been developed on the Indian railways had been less, in proportion to the population, than that of any other country in the world. This was especially the case in reference to goods traffic, but the goods traffic of India was bound to develop very rapidly in the future, and especially in agricultural produce, of which only about 4,000,000 tons are now annually transported, as compared with 75,000,000 tons in the United States for less than one-fourth of the population. and when India has developed a railway system equal to that of the United States, she will be able to supply us with an amount of wheat equal to that now received from America. A statement is going the round of the Press to the effect that a syndicate is being formed for the purpose of raising funds for the establishment of flour mills in India following the lead of the rice milling firms already established there. He said he hoped most devoutly that before the extension of railways and the establishment of flour mills in India takes place, they shall have a sufficiently high protective duty on wheat and flour to render India—and the rest of the world—harmless on that score. We doubt very much, however, if Indian flour—under unrestricted importation—would displace Indian wheat in English market, because the latter owes, much of its demand to the fact of its absolute dryness, rendering it useful for admixture with damp English wheats in the grist.

* * *

POISONOUS HONEY—The flowers of the Kalmia plant and several others ranked as virulent poisons, are frequently robbed of their honey by bees, whose taste does not seem to intimate the existence of any deleterious quality, no more than does the taste of people who afterwards partake of such honey to their cost. It is not mentioned indeed, that this honey, so fatal to man, is at all injurious to the bees by which it is collected, though Mr Darwin tells us that the bees are well aware of the sorts of honey which would

injure themselves and will not therefore touch it. "Perhaps," says the elder Huber, "the sense of taste is the least perfect of those enjoyed by bees, for, contrary to the received opinion, they display little choice in collecting honey; nor do they testify greater nicety in the quality of their water, for the most corrupted marshes and ditches seem to be preferred to the most limpid streams, nay, even to dew itself. Nothing, therefore, is more unequal than the quality of honey, the produce of one district differing from another, and the honey of spring being unlike that of autumn, while even the contents of one hive do not always resemble those of the one which is contiguous. But though bees are thus not very choice in their nutriment and are by no means delicate in regard to the quality of honey, they are far from being indifferent with regard to quantity. They soon discover and consequently frequent the places where most is to be found and they quit their hive much less in regard to the fineness or temperature of the weather than according to their prospects of a plentiful or scanty collection. When the lime tree and black thorn blossom in England, they brave the rain departing before sun rise and returning later than ordinary but this activity soon relaxes. When the flowers begin to fade and when the scythe has cut down the fields of clover, the bees are seldom tempted to go from their home by the most brilliant sunshine.

* * *

PRICKLEY PEAR A SOURCE OF ALCOHOL.—Mr. Thistleton Dyer, Director of the Royal Botanic Gardens at Kew, draws attention to a paragraph in the report on the Government Botanncal Gardens at Mysore which mentions that great "tracts" of cacti exist in Mysore (and probably also in other parts of India) which at present, are useless for any purposes whatever. Possibly as proposed by Dr. Bonavia the country prickly pear of India can be utilized for the purpose of grafting on it good fruty varieties from Malta and elsewhere but failing this the attention of persons in India might very well be directed to the subject of utilizing the fruits of different species of Opuntia for the purpose of extracting Alcohol.

* * *

MR. ALLEN ON BEHAR AGRICULTURE.—"This brings me to the consideration of the main purpose of watching their modes of cultivation, which I did at intervals throughout the year, viz., in order to introduce practical improvements. Here, if anywhere where the soil was poor and the cultivators lazy and ignorant, it might have been expected that some knowledge of scientific agriculture might have been applied with advantage to the usual native practices, but the more I looked into the matter the more convinced I became that I had very little to teach them which they did not already know. The main want of the village was irrigation. No sooner had a well been supplied them than potatoes were introduced of their own accord in place of a less-paying crop, and every inch of the area that could be irrigated from the solitray well was taken advantage of. Another well or two were required, and I included the cost of their construction in the estimates, but the cultivators themselves wanted no teaching that wells were required, and they could select the proper sites for these wells without any help from me. Similarly, though ignorant of surveying and engineering, they could dam the river so as to divert water into their reservoirs, they could clean out the channel and repair the breaches in the walls of their reservoir without any teaching from me, and when I suggested the laying down of pipes and the construction of more distributaries, they were able to estimate the number of pipes required, and to lay out the proper course for the new channels. Nothing again was to be taught them as to the proper crops for the different fields. They were if anything too enterprising in this respect, and year after year tried to grow corn in certain fields which, as a rule, gave no paying results. Where one crop failed, either from the weather or insect pests, they were ready to try another. There was no lack of perseverance and ingenuity, and though they listened to my suggestions with politeness yet generally I found I was only advocating the course they would have naturally followed or that there was some objection which I had not properly considered. It was no use telling them the value of manure. Every scrap of possible manure (with one exception) which was not required for fuel was applied to the soil. On one occasion I called their attention to the condition of a bit of waste land when I considered that manure was being wasted but it was pointed out to me that the fields had only been deserted for a few days while weeding was going on, and that as a rule human *excreta* were as carefully distributed over the cultivated land as I could desire." Our readers need hardly be reminded that Mr. Allen is a Cirencester graduate and his observations quoted above show the caution which scientific training imposes. They are as much averse to reckless and needless innovation on one hand as to hasty generalization and dogmatic assertion on the impossibility of agricultural reform on the other.

* *

ENGLISH VERSUS NATIVE IMPLEMENTS:—The crudity of Indian agricultural tools is well known and it might be expected that in this direction some practical improvements could be introduced. At the outset one is met with the difficulty that the modes of cultivation and the animals employed are

so unlike what are used in England that it would be ridiculous to introduce any implements now in use in England into an Indian village. One fact alone, viz, that the Indian farmer does most of his work, *e. g.*, reaping, hoeing, weeding and the like in a squatting position instead of a standing one debars at once the great majority of English tools and plant. It is essential therefore for any one wishing to improve native implements that he should be an inventor. It is obviously extremely difficult for any one without a special training coupled with an intimate knowledge of native implements to invent or even suggest any improvements that are likely to be generally accepted. Numerous attempts have been made in this direction but with the exception of the Beheea Sugar Mill the new implements have not as yet met with general acceptance. We entirely agree with Mr Allen in his remarks on the improvements of agricultural implements. If the English manufacturer succeeds in making *kodalis*, *kurpis*, and the like of more durable iron at as cheap a cost, the difficulty of introducing the better class of implements in rural districts where there are no wholesale implement-sellers will have to be met. The village blacksmith and carpenter who now supplies the want of his neighbours by making for them new implements, and also by repairing them from time to time as necessity arises, is usually paid in Behar in grain and not in cash. The rates of remuneration have not only been fixed from time immemorial, but varying as they do with the amount of the harvest they are peculiarly suited to the custom of the country. In a good year when the cultivators can well afford it, the village artisans share in the general prosperity. In a bad season they to endure their share in the common adversity. Before English-made implements can be successfully introduced, this ancient usage must be considerably modified, and the advantages of the of the new tools must be very marked before the cultivators will consent to abandon the local artisans. So much for the smaller implements, but as regards ploughs, attempts to improve their shape so as to assimilate them as far as possible to the English plough, have frequently been made. The ordinary plough is spoken of as a mere grubber which merely scratches the soil without inverting it. He thinks the native plough, rude as it is, has been treated too contemptuously. They vary more than casual observers are apt to imagine, especially as regards weight and the depth of furrow they can produce. Ordinary ploughs not unfrequently make a furrow at least six inches deep and the ploughman by going over and over the same piece of ground will thoroughly pulverise and expose to the air the whole upper surface of his field. A plough with a proper mould board would no doubt do the same work quicker and perhaps more effectively but the difficulty of constructing a mould-board which shall do the work effectively and yet be sufficiently light for ordinary bullocks has not yet been properly overcome. The ploughs invented at Baraker and Bhagulpore appeared at first to have accomplished their objects. They were tested several times during the cold weather, and at the Barahpur show a grand trial was held at which fourteen other patent ploughs were tired side by side for three days. The first prize were gained by the Bhagulpore and the second by the Bengal plough. Over a hundred of the latter kind were supplied to Zemindars and ryots in Wards estates. These ploughs were light cheap and in the case of the Bhagalpore plough capable of repair by the local blacksmith, and Mr. Allen strongly advocated their adoption by cultivators; but though they worked effectively in a fairly dry soil which was being prepared for cold weather crops, they were not nearly so good when tried early in the rains on fairly stiff soils which had to be prepared for paddy and *bhadoi* drops. Trials were held at Dumraon side by side with the native plough, and in such soils the latter worked much more easily, and made an equally deep furrow. The mould board appears to be in fault, for it clogged directly, and instead of throwing off the earth it was carried along with a greatly increased stain on the bullocks. The proper curve for an Indian plough has yet to be discovered. It is high time that the craze for ploughs should cease. The ploughs of our ryots work sufficiently well for their purpose. That they do not want any new fangled ploughs, they have repeatedly shown by their cold reception of them. Our agricultural departments had better turn their attention to more promising subject.

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SILK CONFERENCE :—A conference of those interested in the silk trade of Bengal was lately held in Calcutta. Sir Edward Buck, Secretary to the Government of India in the Revenue and Agricultural department was in the chair. In this meeting Sir Edward announced the intention of the Government of India of resigning all official connection with the investigation into the silk industry of Bengal, into the hands of the Government of Bengal. But before resigning all connection with it, Sir Edward explained to the meeting that the gentlemen who have taken a great interst in this industry are Mr. Wardle of England and Mr. Natalis Rondot in France, but their advices differ as to the direction which further direction and action should take. With Mr. Wardle the idea seems to be that improved reeling is required. M. Rondot is more

inclined to think that the worms have deteriorated, and that this has led to the decline of the Bengal silk industry, and he considers that an investigation into the worms and its diseases is the more necessary thing to undertake now. The meeting agreed with Sir Edward Buck in thinking that the most important step to take now is an investigation into the condition of the worm and its diseases; that the Government will not fulfil its right functions in interfering with any of the functions connected with the manufacture of silk. This could be left quite safely in the hands of those who are urged in this direction, by a desire for profit, to do all that can by competition be done to improve machinery, and who are far better judges than any Government officials can be whether the machinery requires improvement or not. On the other hand, the Government can, perhaps, give useful assistance in the way of investigating the conditons under which silk worms are reared, and in dealing with the people who are perhaps more ready now, when one of their own countrymen Mr. Mookherji has take then matter in hand, to receive advice on the subject than they would be from silk manufacturers whom they look upon as having different interests. M. Rondot in his letter states that two things are necessary in his opinion, one that an expert should come out from France to investigate the circumstances under which the worm is reared here and to examine its condition; the other that we should send seed to England to him to be handed over to the principal of one of the seed rearing establishments in France, and who is one of M. Pasteur's pupils. He says that he will be glad to go into the whole question scientifically with the view of ascertaining what the the diseases of the worm are. The other question, as to obtaining an expert from France, was dealt with in the discussion of the subject with Mr. Bizot when he was here, and he was of the same opinion as M. Rondot. The Government of India will, if desired, be glad to arrange with M. Rondot and M. Bizot for the importation of a French expert. In all other matters the direction of all operations in connexion with this subject may be safely resigned to the Government of Bengal. A right step has been taken in commencing this investigation by the efforts which have been made by Mr. Wood Mason, who has been out, at considerable trouble and inconvenience, to the silk rearing villages, and whose work has been now continued by Mr. Mookherji. The proposal of bringing out an expert from France was unanimously approved, the terms were left to be settled by the Government.

CONTRIBUTIONS.

1. Returns of the Rail-borne Traffic of the Punjabfor the quarter ending 30th September 1886. From the Punjab Government.

2. Memorandum on the prospects of the Cotton crop in the Bombay Presidency. From the Government of India.

3. Report on the Riverborne Traffic of the Lower Provinces of Bengal, on the Inland Trade of Calcutta, and on the Trade of Chittagong and the Orissa ports and the Notes on Road traffic for 1885-86. From the Government of Bengal.

4. Prospects of the Wheat crop in the Berar: From the Government of India.

Memorandum on the prospects of the Linseed crop in the Berars from the Government of India.

6. Memorandum an the prospects of the Wheat and Oilseed crops in the North-Western Provinces and Oudh. From the Government of India.

7. Report of the Central Provinces of the Settlement and Revenue for 1885-86: From the Chief Commissioner, Central Provinces.

8. Memorandum on the prospects of the Wheat crop in the Bombay Pressidency: From the Government of India.

9. Memorandum on the prospects of the Wheat and Linseed crops in the Central Provinces. From the Government of India.

10. Memorandum on the prospects of the Wheat and Oilseed crops in the Punjab. From the Government of India.

11. Second General memorandum on the prospect of the Wheat crop of the season 1886-87 From the Government of India.

12. Proceedings of the Agri-Horticultural Society of India for February 1887. From the Secretary.

13. Forecast of the Linseed crops of 1887 in the Central Provinces: From the Chief Commissioner, Central Provinces.

14. Report of autumn or early crops and condition of late crops for 1886-87. From the Director of revenue Settlement and Agriculture Madras.

15. Memorandum on the prospects of wheat crop in Bengal: from Director of Agricultur the Bengal.

Thanks of the Editor are recorded for all the above contributions.

April 28th. 1887.

Dear Sir, I should feel much obliged by your kindly informing me where hives such as those supplied by the late Mr. Douglas and stocks of superior Bees can be had with an approximate estimate of the cost of it, trusting you will forgive the liberty I have taken in writing to you.

Believe me to be Yours faithfully
M. R. Wylie

Rastumpore 15. 4. 87.
Via S. Badhupur

To

The Editor of the Indian Agrl. Gazette
Calcutta.

Sir,

You know very well that I have taken up 3500 ares of waste-land in Panch Mahals where precious crops of cotton, wheat, tobacco and other seeds, were

simply a matter of dream, but now I have much pleasure to state that cultivation on a scientific system is far advanced on this side which leads us to believe that it will eventually do immense good both to the British Government and the poor settlers on this side.

I have made three experiments on my own farm which I hope you will kindly give corner to in your wide spread journal.

1st Experiment—*Mahagany plants*

I received seed on the 15th of October 1886. W Winter Esq. the then worthy Collector of Panch Mahals was good enough to send me seeds. I sowed them on the 16th, that is, next day after I received them. The soil was black by itself to which red loamy soil was added in an equal quantity and was mixed with cow and sheep dung manure in ½ the quantity of the whole. I got complete success in a seedbed thus prepared, but to my great astonishment I am sorry to let you know that I got total failure in an earthenpot as suggested by Mr. Shearer. I again sowed spare seeds both the ways on the 9th December. I transplanted them in pots on the 2nd of January 1887 when they attained the height of about four inches. Plants at present look very healthy.

2nd Experiment—*Tobacco native.*

Seed-bed was on a high land and not manured, because it was "gabhan" ground used for building house, but it was burnt before the seeds were sown broadcast on the 3rd July 1886. I paid great attention to clean weeds. The soil of the field was *besur* (mixture of black and gorat soil) which measured two acres. I manured the field with ordinary cowdung at the rate of 16 carts per acre. I commenced planting on the 23rd of August 1886. I planted them in square rows at the distance of three feet from each other. I preferred square system of sowing because I found it convenient and safe to harrow the field from both the sides. Watering was not required as it was then raining here. Leaves were dried up in sunshine for four entire days and then weighed 112 maunds of 40 seers. Last rain in the month of October washed off the sticky substance; however the quality was fine.

3rd Experiment—*American Cotton*

I tried this cotton on black and besur soil on the 21st June 1886. I sowed with a plough and a "fudka" (an instrument having two rows) but did not get success, either through continuous heavy downpour for three months or through early sowing. It is however satisfactory that the pods burst satisfactorily and the quality is fine and silky as also the staple is long. I sent the sample in the Neriad Agricultural Exhibition which was held on the 29th of January 1887 and I have the greatest pleasure to state that I got the 1st special prize certificate of honour. I have a great mind to try it again next season and shall let you know its result in due time.

Yours &. &.

Bamanjee-a-Dalal.

ON THE USE OF FERROUS SULPHATE AS MANURE.

Vegetable physiology assures as that iron is essentially necessary for the growth of all agricultural plants, that without iron there can be no assimilation of plant food and hence no growth. As a rule the soils of arable lands are seldom deficient in this element, which, therefore though an essential part of plant-food, has not received much attention from agriculturists in general or agricultural chemists in particular. We have therefore been watching with great deal of interest the investigations of Mr. Griffiths of London on the use of sulphate of iron as a manure for certain crops. His investigations on the effects of this salt on crops began as far back as 1883, and have been carried on continuously ever since. During the first year of his regular experiments, one plot was treated with crystallized ferrous sulphate of commerce, the quantity applied being half a hundredweight to the acre and the other was left in its normal condition. Both plots were otherwise similarly treated and situated. On both the same amount of bean seeds was sown. These were allowed to grow until ready for gathering, when they were gathered and weighed, then allowed to dry and weighed again. The plants grown with the aid of iron-manure yielded 56 bushels of grain, while the plants grown without it yielded only thirty five bushels of grain. So far as this experiment went, sulphate of iron evidently conferred great benefit on the crop. A certain number of the plants grown on each plot was separately reduced with the greatest possible care to ashes, which showed on analysis large increase of iron oxide and phosphoric acid in the pods minus the seeds. The results may be summed up as follows.—

1st. That by manuring the land with half a hundredweight of ferrous sulphate to the acre, the harvest was increased. The manured land gave an increase of 1573 lbs in the total weight of the crop when gathered; 1395 lbs when dry (straw); and an increase of 21 bushels of grain over the crops grown without the iron manure.

2nd. When the ashes of the entire plant were submitted to analysis, it was found that the plants grown with an iron manure contained a much larger percentage of ferric oxide in their ash than the

plants grown without the manure; it was also noticeable that the phosphoric acid in the ashes increased as the iron oxide increased.

There is a precaution however in the use of ferrous sulphate which must be mentioned. Entire crops may be killed and instances are recorded of their being killed by having the land manured with farmyard manure along with ferrous sulphate. The farm yard manure reduces the sulphate into sulphide and acids acting upon the sulphide generate sulphuretted hydrogen which causes great mischief to the crops.

During next year (1885) Mr. Griffiths continued his researches into the growth of Leguminous, root, and cereal crops with and without iron sulplate. The three crops experimented with were beans, wheat, and turnip, each of which was grown on two plots of land, one manured with half a hundred weight of ferrous sulphate to the acre and the other un-manured but otherwise similarly treated and conditioned.

1st Bean :—The crop of beans grown by the aid of the iron manure yielded 44 bushels of grain, while the crop grown without the manure yielded only 28 bushels; so again there was a marked difference in the produce of manured and unmanured plots. A comparison of the ash analysis of the entire plant this year with that of the previous year bore out more plainly that phosphoric acid in the ash increased as the ferric oxide increased. It was also plain that there was no difference in the composition of the ash of seeds whether the crop was grown with or without iron manure.

2nd. Wheat crop :—As with beans, the wheat was sown on two plots similarly conditioned and similarly situated, of which one was manured with iron sulphate (½ cwt to the acre) and the other left un-manured. The crop grown with the aid of the iron-manure yielded 28 bushels of grain while the crop grown without it yielded 27 bushels; so iron sulphate did not appear to be of so great a value to cereals as to leguminous crops. But there was one thing in favour of the use of iron sulphate for wheat, namely, the plants were healthier and completely resisted the attack of mildews; while the crop not so manured was attacked to a certain extent. The ash analysis of the entire plant and of the seed did not show any very marked increase in the proportion of ferric oxde or phosphoric acid in the crops of the manured plot.

3rd Turnip :—As before two plots were chosen, one manured with the usual dose and the other not. The plot manured with ferrous sulphate gave 16½ tons, whilst the plot left unmanured gave only 13 tons of roots. It was evident that iron sulphate was beneficial to the root crop. The ash analysis of the roots showed an increase of nearly four times the amount of ferric oxide in the roots grown with the iron manure over those grown without it.

Another series of very important analysis was made by the investigator to determine the effect of iron sulphate on the quantity of nitrogen, soluble carbohydrates, woody fibre and fat The analysis showed that all of them were more or less increased when the plants were grown with the aid of ferrous sulphate.

Continuing his experiments on the use of iron sulphate as a manure during 1886, the investigator observed that the crop of wheat grown by the aid of iron sulphate yielded no very remarkable increase in grains as in the case of bean crops and that the percentage of ferric oxide in the ash was about half a percent over those grown on the normal plot and that it resisted the attack of mildew.

On grass land, iron sulphate had the remarkable effect of destroying the moss infesting the grass and making the latter grow more luxuriantly. The ash analysis showed a large increase of ferric oxide and phosphoric acid to which the healthy appearance after the addition of iron sulphate was due. The analysis of the dead moss showed a very large increase of ferric oxide to which no doubt their destruction was due.

To determine whether iron sulphate has any effect on the growth of potatoes three plots were selected, the first plot was left normal or unmanured, the second plot was manured with—

1 Cwt Kainite
1 Cwt Nitrate of Soda
½ Cwt Iron Sulphate
2 Cwt Superphosphate

per acre, and the third plot was manured with the above constituents minus the ½ cwt of iron sulphate. The crop grown with the addition of iron sulphate yield d 8½ tons of potatoes, while without iron sulphate it yielded only 6½ tons and the normal plot gave only 3 tons. Hence it was evident that iron manure was benefical for the growth of potatoe crops, largely increaseing the yield as well as the quality. The ash analysis showed that the addition of iron as manure was followed by the increase of ferric oxide and phosphoric acid in the ash

During the current year the experiment on grass land was taken up again with the result that the grass manured with iron sulphate grew far more rapidly than the grass not so treated, and was of a beautiful green color. The former yielded 3 tons 2 cwts of hay and the latter only 1½ tons. On subjecting a fair sample of the hay to analysis, it was found that the percentage of albuminoids and carbohydrates showed larger increase in the hay grown with iron manure. As in the previous year, ash

analysis showed a large increase in both ferric oxide and phosphoric acid. The value of iron sulphate on bean crops was confirmed for the third time during the current year.

The following general conclusions may be drawn from the above:—

1st. In plants having large leaf-area, for example, beans, cabbages, turnips, and mangels, an iron manure is most beneficial, considerably increasing the harvest.

2nd. An iron manure greatly increased the soluble carbohydrates, albuminoids, etc, this of course being the outcome of the increase in the amount of chlorophyll in the leaf which is the active agent of assimilation.

3rd An iron manure greatly increased the quantity of ferric oxide in the ash of almost every crop experimented with and also of phosphoric acid in some.

4th The ferrous sulphate in moderate dose is a good plant-food as shown by increase in the harvest return; yet in *excess* it acts as a poison to plant life, a solution containing ¼ percent of ferrous sulphate being fatal to most plants; and when the amount of ferric oxide in the ash of all the plants examined was 10 *per cent* of the plant previously dried.

5th Iron sulphate acts in the soil as an antiseptic agent destroying to some extent certain parasitic diseases which attack our crops. This salt also appears to have retentive properties for ammonia and phosphoric acid.

MANUFACTURE OF OIL CLOTH.

Oil-cloth is largely used in this country for making water proof covering for packages and bags, the roofs of palankeens and various other purposes; but such an useful thing as this and one that can be manufactured very easily, we have to import from foreign countries. Being asked by many correspondents to give them an outline of its manufacture, we propose to describe briefly the salient points of the manufacture

The basis of oil-cloth is coarse canvas generally made of jute. The length and breadth of the canvas varies according to the nature of demand and supply. The canvas on being taken to the works is cut into convenient lengths which are then nailed to upright frames, which are provided with screws by means of which the fabric can be uniformly stretched. Too much strain, however, must not be put on the cloth, as the shrinkage which takes place when it becomes wet will cause it to give way. At convenient intervals of height, opposite each frame are stages or platforms on which the workmen stand while preparing the surface. The first operation to which the framed canvas is subjected is "size priming," which consists in brushing its surface with a weak solution of size. The object of this is not only to give a body to the cloth but also to portect the fibre from injurious action of the acid products generated during the oxidation of the linseed oil which is subsequently applied. Cloth which is covered with paint without a protection coating of size soon becomes rotten and brittle. The surface of the canvas is much smoother after priming, yet a number of fibres still project, and to remove these the cloth is either rubbed while still damp with flat pieces of pumice, or it is allowed to dry and is then sheared with knives. Sometimes the drying of the size is accelerated by admitting hot air into the building in which the frame is situated. When the priming is thoroughly dry, and the face of the canvas freed from loose fibres, the first coat of paint is applied commencing, as in sizing, at the top of the cloth. The consistence of this paint is much thicker than for ordinary painting purposes. The pigment in general use is yellow ochre. Sometimes red oxide of iron is substituted; but paint mixed with this substance does not dry so well. The first layer of paint is not applied by paint brushes, but with the help of long steel trowels, similar in shape to those used by plasterers. The paint is well worked into the interstices of the canvas and the excess is scraped off by the edge of the trowel. Both sides of the canvas are treated in this way and are then allowed to dry either with or without the aid of artificial heat. When the first layers of paint are sufficiently hard, another coat is laid upon the side which is intended for the back of the cloth. As soon as this dries, the back is finished with the exception of any trade mark which may be necessary, and which should be applied at this stage. The first layer of paint on the face side of the cloth is rubbed with lump pumice before the next coating is applied. This is again done with a trowel and the operations of trowelling, drying, and pumice scouring are repeated three or four times, according to the quality of cloth to be produced. When sufficient thickness has been obtained, the face coating is applied. As this forms the ground work of the pattern which is subsequently printed on the cloth, it requires more care both in mixing and laying on. A brush is used in the latter operation instead of a trowel. When this last coat is sufficiently dry, the whole piece of oil-cloth is cut down from the frame and left in a dry place to be seasoned.

ON THE USE OF NITRATE OF SODA OR POTASH AS MANURE

Under ordinary conditions of farming, agricultural plants can not give a satisfactory yield without the use of nitrogenous manures. Dung or as it is more commonly called farm yard manure is, as a rule, insufficient to supply the full quantity of nitrogen needed by the crop. Hence it is that artificial sources of this element must be resorted to. Amongst the numerous introgenous manures of commerce, the English and European farmers have picked out nitrate of soda as the best and sulphate of ammonia as the second best.

Manures containing nitrogen in the form of animal matter require a long period in the soil to undergo conversion into nitrate in which form principally, if not alone, can nitrogen be made use of as plant food ; nitrate of soda or nitrate of potash, on the other hand, is at once available. It is therefore specially adapted to inducing rapid nutrition and vigorous growth of crops, whilst owing to its ready sovency, it acts as a manure to the subsoil and causes the roots of plants to penetrate more deeply and thereby avail themselves of the presence of moisture and food ingredients at greater depths. On the other hand the easy solubility of the nitrate makes it liable to be easily washed out of soils through drainage water. Sulphate of ammonia containing the same amount of nitrogen as nitrate of soda generally fails to produce the same effect. Besides the injurious impurities which are often found in sulphate of ammonia and sometimes occasion great damages are never found in nitrate of soda. The addition of phosphates and of salts of potash increases materially the efficiency of the nitrate. Hence it is that in India where nitrate of potash occurs naturally as efflorescence in many soils and where it is not quarter so expensive as in England, nitrate of potash produces marvellous result when applied to cereals especially wheat. Credit however must be given to the provincial agricultural departments in making known to our ryots the great value of nitrate of potash as a manure for crops in general and for cereals in particular. Inquiries are very often made of us by the ryots as to the quantity per *bigha,* the mode in which, and the time when it is to be applied ; but naturally averse as they are to purchased manures, the excise upon it makes it doubly odious to them and until this excise be abolished, at least in their favour, nitrate of potash can hardly be expected to become a general favourite.

The use of nitrate of soda or potash does not unduly exhaust the soil as is believed by some, its action may be said to be twofold, viz, directly to supply plant food, and indirectly to render the mineral plantfoods present in the soil more assimilable, though not more of them is removed than can be accouted for in the increase of crop. The results of the celebrated experiments at Rothamsted experimental farm may be quoted in confirmation of the above statement.

The crops most benefited by nitrate of soda or potash are the cereals ; next in order come such cruciferous forage plants as rape, mustard and their alles, aswell as tobacco, flax, hemp, buckwheat etc ; vines, orchard trees, fruit bushes are also highly responsive to the influence of nitrate. The meadow grass takes up nitrogen as readily as corn crops and may be dressed with it for ornamental purposes. The crops which respond least to the nitrogenous manuring are, as is well known, precisely those which contain most nitrogen in their composition, namely, the leguminous crops such as peas, grams, pulses, etc.

On sandy and other porous soils, nitrate of soda should be used only as a top-dressing and is best applied just after vegetation has commenced, though it may be added at a later period. Thirty seers to one maund of commercial nitrate of potash will be a sufficient topdressing for a bigha of wheat. Before being applied to the soil, it must be finely powdered and mixed with at least half its weight of dung ashes if available or failing that of powdered dry earth. On irrigated lands, the best time to apply it is immedeately after irrigation ; on dry-lands immediatly after a shower of rain. For more detailed discussion of the use and application of nitrate of potash as manure readers are referred to the first volume of this journal.

SUGARCANE.

Sugarcane is extensively cultivated throughout the Burdwan division. The red clay of the western part of the division is rich in phosphorous and very well suited to cane-growing. On account of the necessity of irrigating the fields at a time when water is very scarce, the cultivation of this important crop can only be undertaken in particular localities. Of late the area under cane has somewhat decreased from a variety of causes, the most important of which are (1) the extension of the cultivation of potatoes, (2) the great damage done to cane by floods, various diseases, wild animals, and insects, especially by white-ants, and (3) the uncertainty of the water-supply during the last few years, the distribution of rainfall having been very irregular.

VARIETIES.

The different varieties of sugarcane under general cultivation are (1) the *samshara,* (2) *kajali,* (3) *Puri-*

and (4) the *Bombay*. Near Burakar a variety of sugarcane is grown which requires scarcely any irrigation. It is known by the name of *Khari*, and is a very inferior cane, small sized, extremely hard, and deficient in juice. The Bombay is a large sized red cane of very superior quality. The rind is soft the inter-nodes large, and the juice is abundant and rich in sugar. But it is a very delicate cane, specially liable to disease. Ten or twelve years ago hundreds of fields of Bombay cane were totally destroyed, by a disease to which the cultivators gave the name of *Dhasa*, or rot, which reduces the plants to a rotten mass emitting a most disagreeable odour. Being a soft cane, the damage which wild pigs and jackals do to it is very great. It does not stand the effects of flood and excessive rainfall. This variety of cane has, for these reasons, almost gone out of cultivation, and only a few plants are now met with intermixed with other varieties of cane. Of the different varieties now under cultivation, the *samhoara* occupies the most prominent place. It grows to a large size, the rind is fairly soft and the juice is good both as regards the quantity and quality. It stands stagnant water fairly well. It has a pale yellowish-white colour. This is the variety most extensively cultivated in the Burdwan and the Hooghly districts. The *kajali* and *Puri* are the canes most cultivated in the Beerbhoom, Bankoora, and the Midnapur districts. These are small-sized canes, much inferior to the *samshara*, but extremely hardy.

Soil.

Sugarcane may be grown alike in the clay and the red sand of the division, but preference is given to a mixture of the two. It grows luxuriantly in the dearah lands if these be above the inundation level, but on such soils the juice is somewhat watery and deficient in sugar.

Rotation.

Indian cultivators do not follow rigidly any system of rotation in this any more than in case of any other crop. Cane is regarded as a very exhausting crop, and it is not planted on the same field more frequently than every fourth year. It may come after any of the following crops, viz—(1) one of the pulses, (2) potatoes, (3) *aus* paddy (4) wheat or barley and (5) mustard, and is always followed by *aus* paddy. Sugarcane does not do well after wheat or barley, and the only variety of cane so grown is *kajali*.

Preparation of the Field.

When sugarcane follows potatoes, the land is almost ready for the reception of the cuttings without any further preparation. Two or three ploughings and harrowings are all that is necessary. In other cases the land is repeatedly ploughed and well exposed to sun and air. The first ploughing should better be given in Kartick, 15th October to 15th November Deep cultivation being a necessity in case of sugarcane, after the land has received a ploughing or two, it is hoed by the *kodali*. This is an expensive operation, but is more than repaid by the increased outturn. From Kartick to the time of planting, the land should be ploughed as often as opportunity offers. If no hoeing be given, it will require no less than 10 or 12 ploughings. With one hoeing about half as many ploughings will suffice. When the ploughings are going on, the fields are manured with cowdung, and the sweepings of the cow-shed. When sugarcane follows mustard or pulses, these latter crops are grown as catch crops. The ryots go on with the preparation of the land as usual, only the ploughings are stopped for some time, and the cowdung is not applied till the mustard and the pulses have been gathered, and the first ploughing has been given. After the soil has been well exposed to sun, air, and rain, and thoroughly pulverised to a depth of not less than 9 inches, the land is levelled as perfectly as possible by passing the ladder several times over the field, when it is ready for the reception of the cuttings.

The planting time extend from the beginning of Pous 15th December to the end of Baishakh (15th May) but it is in the month of Falgun (15th Feb. to 15th March) that most fields are planted. A late planted cane field does not do well, but for want of timely rains the ryots in some places postpone the planting till the first shower of rains in Baisakh. A late planted cane gives only a partial crop, but when the cane is planted in time and their is not sufficient water to irrigate the field afterwards, the crop is almost totally lost. It is therefore simply a selection of the lesser of the two evils.

Planting.

Sugarcane is propagated by cuttings, and for this the ryots of Bengal almost invariably use about a foot of the stem from the top end. They are opposed to using the lower portions of the stem, not only because that would be expensive, but because the buds at this portion are seldom in proper condition to give strong healthy plants. When the cane is pressed for juice, the tops are set aside for planting purposes. With regard to the use of those tops, three different cases may occur: 1*st*, the tops are stripped of the leaves, cut into pieces 6 to 8 inches long, and the cuttings are immediately planted; or 2*nd*, when the cultivators can afford to wait, these cuttings undergo some preliminary preparation before being used. A hole is made some 3 feet deep where water is close at hand. The cane cuttings are

rubbed with pond mud and a little oil-cake and placed in the hole, which is then covered with straw or cane leaves. Water is daily applied to the cuttings to keep them slightly wet; when the buds have somewhat enlarged, the cuttings are ready for use; or thirdly the cane fields not being yet ready for planting the tops have sometimes to be kept a long time before they are needed. When this is the case, a hole is dug close to a pond and the bottom of the hole is made into mud into which the cane tops are driven almost in a compact mass for about two or three inches. Water is now and then applied to keep the tops cool. In this way the cane tops may be kept uninjured for a long time. When needed for planting they are taken out, the leaves are removed and cut into convenient lengths.

A good method of preparing the cuttings is to keep them for about a week in moist sand.

When planting the cuttings, the beds are so arranged as to serve a double purpose, namely, to give facility for irrigation and to remove the rain water from the field as speedily as possible. This is done first by dividing the field into a number of long strips by broad trenches, which will be referred to as main water-channels, drawn from the top to the bottom of the field at intervals of some 40 feet. A number of smaller water channels are now drawn across the field, all parallel to one another, and about 7½ feet apart. The whole field is this way divided into a number of small beds each 40 feet by 7½ feet. The water channels are all made by the *kodali*. Now taking a good plough and a pair of steady bullocks, parallel furrows are drawn across these beds at intervals of about 22 inches. Finely-powdered oil-cake is then spread on the bottom of these furrows at the rate of about 4 maunds per bigha. When all this has been done, water is poured from a *ghara* into these furrows, and in the mud thus made cane cuttings, called tickless, are placed lengthwise, leaving an empty space of about 9 inches between each. The cuttings are then covered with a little earth. In planting the cuttings care should be taken to have the buds placed laterally. The cuttings should not be put deeper than is necessary for the shoots will thus be prevented from coming out, but at the same time sufficient earth should be placed over them to save them from the scorching effect of the sun. A layer of earth about 3 inches thick is about the right quantity. This is the system generally followed.

The mode of planting canes described above is not followed throughout the division. In some places, after the water channels have been made, holes are dug in parallel lines at intervals of about 24 inches and at a distance of 18 inches from one another in the line. Cuttings are put in these holes, one in each, with a little oil-cake and water, and covered with earth. This is the system followed on the southern bank of the Damoodar, the best cane-producing tract in Western Bengal, and differs very little from the Mauritius system. Near Hooghly, where canes are planted rather earlier than elsewhere the water channels are not made at the time of planting the cuttings. When the planting is finished, the soil on both sides of the furrows are raised by the *kodali* and placed along the lines in which the canes have been put, so that the field seems to be laid in ridges. The soil there is very light, and unless this plan is adopted the cuttings are soon burnt up. The mode of planting sugarcane known as the Mauritius system, which has been strongly recommended by Messrs. Mylne and Thomson of Beheea, is not unknown in Bengal. It differs little from that practised near the Damoodar, and is exactly the same as that followed by the market gardeners in the neighbourhood of Dacca and Calcutta.

After-Treatment.

After the canes have been planted, unless the ground be kept sufficiently moist by occasional rain, the fields have to be watered every 4th or 5th day. This is generally done by pouring water from a *ghara* along the lines in which the cuttings have been placed. The shoots begin to make their appearance in about a fortnight, the time depending on the more or less forward state of the buds at the time of planting and the amount of moisture in the field. When most of the shoots have come out, the field is irrigated by flushing it with water, and in two or three days it will be in a fit condition for hoeing. The space between the furrows is hoed with a *kodali*, and then by holding the edge of the *kodali* parallel to the line in which the cuttings have been placed, the crust formed is carefully broken up and part of the earth from over them is removed. Some of the cuttings which failed to put forth shoots before will do so now. Places which show no signs of shoots coming up, a week after the hoeing has been given, have to the planted anew.

In a fortnight a second irrigation will probably be needed. In fact, till the rains set in, it will be necessary to irrigate the field twice a month if not oftener, and after each irrigation the space between the furrows should be once hoed. The plan followed with regard to cane fields of watering the soil and of stirring and exposing it to sun and air repeatedly, probably helps the growth of the plant quite as much as the manures so liberally used.

When the shoots have all come out the operation of earthing up the plants begins, and the furrows

along which the canes were planted are converted into ridges. But care should be taken not to earth up the plants too soon, for as soon as this is done they cease to tiller. All through the rainy season special attention should be paid to keep all the water channels perfectly cleared, so that rain water may be removed as quickly as possible. Stagnant water is most injurious to cane fields, and after each shower of rain, as soon as the field is in a proper condition, a hoeing should be given, so as to keep the soil loose and to destroy the weeds, which have a very vigorous growth at this time of the year. After the second week of Bhadra, and till Kartick it is necessary to hoe only once a month. The operation of tying up number of plants with the mature leaves begins in Sravan and continues till Aswin. This is done twice a month. When this operation is first undertaken the dead leaves are stripped off. The covering of the stem with leaves is an important operation serving a variety of purposes and should not be neglected. It affords support against the action of high winds, protects the plants from ravages of jackals, and increases the space between the plants so as to promote ventilation. Some are of opinion that this operation tends also to increase the amount of sugar, but whether this is a fact can only be ascertained by experiment.

At the end of Sravan or beginning of Bhadra, about four or five maunds of oil-cake are applied per bigha as a top-dressing. Sometimes oil-cake is applied thrice—one at the time of planting, a second time in Sravan, and finally in the beginning of Aswin. Sometimes it becomes necessary to irrigate the field once or twice in Aghran.

Manures.

Sugarcane fields are very heavily manured. The manures generally used are cowdung at the rate of 30 maunds and oil-cake about 10 maunds per bigha. In Beerbhoom pig's dung is regarded as the best manure for cane, and pig's dung, we know, is particularly rich in phosphorous. The ashes of *begass* are thrown into the dung heap, and are not separately used for sugarcane alone. In some of the newly-formed dearah lands the amount of manure used is extremely small.

Diseases, &c.

Much injury is sometimes done by white ants to canes just after planting. Another insect known as *majera*, a small grub with black mouth and very sharp teeth, eats the crown of the bud just below the mid-leaf stalk, which soon withers away. When the plants have just sent forth shoots above ground they are in some places likewise eaten off by hares. At this stage also plants sometimes die for want of water, and while still very young they sometimes suffer from rust.

At a more advanced stage of growth much injury is often done to sugarcane by wild pigs and jackals. An insect named the *cane borer* bores through the stem and passes a stage of its life within it. As stated before, the variety of cane known as the Bombay is sometimes totally destroyed by a disease named by the ryots the *dhasa* or the rot. The disease seems to be due to fermentation, induced by some microscopic vegetable growth within the plant.

Ratooning.

When the canes are cut away, the stool or the underground stem is allowed in some places to send forth fresh shoots, and a second crop is thus obtained. In the Bankura district the second crop gives a better outturn than the first, and there sometimes a third crop is also taken. Ratooning, however, is not popular with the ryots of the Burdwan district. According to them cane is such an exhausting crop that it ought not to be allowed to remain in the same field for more than one year at a time. But the process has one great advantage. Ratooning gives the earliest crop of cane, and this is a consideration deserving of particular attention near large cities. To obtain a good and early crop of cane by ratooning, as soon as the previous crop has been harvested, which should be done early, the field should be watered, liberally manured, and hoed.

Harvest.

The harvesting season is supposed to begin on the last day of Pous, on the occasion of the Hindu festival of *Pous Sankranti*, but as a fact the harvesting is generally delayed till a month later, and is not quite over till the month of Chaitra.

The harvesting of cane is a complex operation consisting of three parts, namely—(1) the cutting of the canes. (2) the extraction of the juice, and (3) the boiling of the latter into *gur*. To avoid fermentation of the canes or the expressed juice, and the consequent loss of sugar, these three steps must follow one another as quickly as possible. The canes are generally cut by *kodalies* close to the ground. They are then stripped of the leaves and the are cut off. For the extraction of the juice three different forms of country mill are in use in the Burdwan Division:—

(1) The first called *charki*, consists of two horizontal wooden rollers furnished with screws fitting into each other. This machine is worked by two men sitting at either end, who turn the spokes attached to one of the ends of each of the rollers. A third man feeds it with canes, and a fourth man sitting opposite to him receives the half-crushed canes and gives them back to the third man. The canes must be passed and repassed several times,

and even when this is done a large percentage of the juice escapes extraction.

(2) The second consists of two stout wooden rollers placed vertically with a lever attached as in the Behea mill and is worked by a pair of bullocks. Three men are required to work this mill—one to drive the bullocks another to feed the mill with cane, and a third to assist him, as in case of (1). This mill seems to be copied from a Bombay pattern.

(3) The third form is the *kalu* or *ghani*, and acts on the principle of a mortar and pestle but instead of the up-and-down motion of an ordinary pestle in the *kalu*, the pestle is rolled against the sides of the mortar by a lever attached to it.

All these forms of wooden mill are now being slowly superseded by the Behea sugarcane mills. But the prices at which these useful implements are sold are so high that it is quite beyond the means of the generality of the ryots of this division to b[illegible]. They are generally purchased by mahajans who let them out at so much a day, sometimes at as high a rate as Rs. 2.

The number of men required to make gur by the country mill, and the arrangements necessary for the operations, are described below :—

(a) Two men are required to cut canes, to remove the tops and leaves, and to carry the canes to where the mill is working.

(b) Four men to work the *charki* a whole day, two men working at a time.

(c) One man to feed the mill with canes.

(d) One man to receive the canes and give them to the feeder to pass them again through the mill.

(e) Two men to attend to juice boiling.

(f) One man attends to the furnace.

About 3 or 4 maunds of *gur* may be made in this way daily.

The boiling of the juice into *gur* as conducted in most parts of the division is a cumbrous operation, and compares very unfavourably with the practice followed in the Shahabad district. Both in making the *gur* and refining it into sugar the Shahabad ryots are far ahead of the cultivators of the Burdwan Division. Iron pans are generally used only in the Beerbhoom district, and there the pans are made on a wrong principle, the edge of the pan being turned up and placed at right angles to the bottom. When earthen pans, or rather pots are used, as is generally the case in the Burdwan and Hooghly districts, a huge furnance is required. A plot of ground is selected as close to the field as possible, and in this a hole is dug out about 10 feet long, 4 feet broad, and 5 feet deep. Over this is placed a wooden or bamboo frame-work lined with earth for the reception of two series of pots. The hole is open at both ends, through one of which the furnace is fed with fuel, and through the other the ashes are removd from time to time. The fuel used consists of cane leaves and dried *begas* or canes stalks from which juice has been extracted The number of pots used is generally 12. The juice as it begins to thicken is brought from one pot to another till it finds its way to the last two pots nearest to the furnace mouth. In these two pots or in some places in one of them the juice is allowed to attain the consistency of treacle when it is removed to large earthen vessels capable of holding from two to three maunds of *gur* each.

Lime water is sometimes used to neutralise the acidity of the juice caused by the canes being in bad condition or by the extraction of the juice or boiling being delayed. Milk diluted with water is added to the boiling juice to assist coagulation, and to bring to the surface the scum, which is carefully removed.

Sugar refining is not an important industry in this division, the *gur* being sold and consumed mostly in the raw state. An inferior kind of sugar known as *dolo* so called from being moist and cloddy, is sometimes made. When the *gur* in the earthen pots in which it is kept has become granular and has separated from a portion of the uncrystallizable sugar, it is put in gunny bags, which are pressed laterally by means of bamboo slips tied together. These bags are placed on earthen vessels called *gumlas*. After the greater part of the molasses has thus been got rid of, the *gur* is removed to baskets placed over *gumlas* and covered with a water weed called *ganj* (*Vallesneria spiralis*). This weed has an astonishing purifying quality. The molasses pass through the mesh of the basket, and a layer of the *gur* at the top is bleached into a yellowish white sugar, which is removed every alternate day and the weed changed. The bleached sugar is dried in the sun and trodden under foot, when it becomes the *dolo* of the market.

To be continued.

NEWS.

Estimated outturn of the Wheat Crop in the Lower Provinces of Bengal for season 1886-87.

The cultivation of wheat on a large scale is in the Lower Provinces confined to the Patna and Shahabad districts of the Patna Division, and to the Bhaghulpore Division. Excessive rain during september and October last made it impossible to prepare land for wheat in due time, and the crop has, moreover, suffered from rust, brought on by heavy rains in January. On the whole, it may be said that the area sown was less than the normal, and the outturn will be about three-fourths of the average.

Prospects of the Wheat and Oil-Seed Crops in the North-Western Provinces and Oudh.

The Report up to 22nd February 1887 is as follows:—

There was heavy rain in Bundelkhund and parts of the Allahabad and Rae Bareli Divisions between the 10th and 12th December, but the regular winter rains did not commence till 4th January. The showers in January were copious and did much good, but cloudy weather caused fungoid diseases which affected both wheat and oil-seeds. In February frost was severe and the early crops on outlying unwatered land suffered seriously. Taking 100 to denote full average condition, the February condition of the present wheat crop of the United Provinces was 75 and of oil-seeds 60. Frost is reported to have destroyed fully half of the *arhar* *dall* crops and much of the peas and gram crops. This forecast relates to condition of crops up to 22nd February 1887."

Prospects of the Wheat and Linseed Crops in the Central Provinces.

The second report is as follows:—

The monsoon of 1886 was characterized by a very long break in August and September which ruined large proportion of the rice crop and made the prospect of the *rabi* sowings look at one time very precarious. A considerable area of linseed was sown much earlier than usual as the weather towards the end of September seemed to have settled fine and people were anxious to avail themselves as far as possible of what moisture remained in the ground.

With the commencement of October, however, rainy weather set in throughout the Provinces, and in some places quite exceptionally heavy falls occurred. In Nagpur no less than 9 inches were registered during the month of October. This secured the prospects of the *rabi* sowings, but did an immense amount of damage to the considerable area on which linseed and wheat had been previously sown. In the Nagpur and Wardha districts a large proportion of this area was ploughed up and sown with wheat, and in Raipur and Bilaspur an extensive area had to be twice sown with wheat, the earlier sowings having failed altogether. During November and the first half of December the weather remained tolerably clear but in the middle of December a fall of rain occurred which was especially heavy in the western portion of the Narbada Valley. Nimar received close upon four inches. A good deal of rain fell again during the first half of January, and at the end of that month and in the beginning of February frosts occurred in the Northern districts which are reported to have done some damage. The rainfall of the monsoon had been over a large area of the Provinces so short, that, had cold weather rains not occurred, the crops must have suffered from lack of moisture, and there is little room for doubt that the rainfall of December and January greatly benefitted the wheat, although in some places, and principally in the Nimar district, it induced an attack of rust which did great damage. A fair wheat crop may be expected, and it is thought that in some cases the anna estimates would have been higher than they are, were it not that 16 annas is popularly considered to express a full and not an average crop The wheat harvest will probably be an exceptionally good one over a large portion of the Nagpur and Wardha districts. The linseed crop, on the other hand, is in the Northern districts very little better than it was last year, when it was almost a total failure. Rust has again attacked it, due, it would seem, principally to the fall of rain which occurred in the middle of December as, in the south of the Provinces and in Chattisgrah, where comparativ[illegible] rain fell, [illegible] half to a two-thirds crop is expected. Under the orders of Government some general information is to be given in these forecasts regarding the prospects of food crops other than those to which the forecasts relate. In the districts of Chanda, Bhandara Balaghat, Raipur and Bilaspur the rice crop is of very great importance and rice is largely consumed by the people. It has already been mentioned that owing to the lack of rain in August and September rice suffered severely. In the three districts first named the crop was not, on a liberal estimate, more than a half crop, while in Raipur and Bilaspur it gave an outturn of only 5 annas in the rupee, or even less than this, over a very large portion of the country. The price of rice is consequently very high. Over the rest of the provinces millets are the food-crop next in importance to wheat and, though, in some of the more hilly tracts, these suffered from the scantiness of the rainfall, speaking generally a fair crop was gathered. The *juari* crop of Wardha and of the Berars was an exceptionally good one.

Prospects of the Wheat Crop in the Punjab.

The report to end of January 1887 is as follows:—

Estimated area 6,900,000 acres. There has been good rain in the districts near the Himalays, but none in other tracts. Rain is now much needed, especially in the western districts."

Prospects of the Oil-seeds Crop of the Punjab.

The report up to the end of January [illegible] follows:—Owing to want of rain area [illegible]

seeds in selected districts still further reduced. Estimated area now 414,000 acres. Rain much required.

Prospects of the Wheat Crop in the Bombay Presidency.

The second report, which is for the period ending 20 February 1887, is as follows:—" *Guzerat* area about 375,000 acres Ahmedabad 200,000 acres, Broach 100,000 acres; rest scattered. Injury from frost and rust reported from parts of every district, estimated yield in chief wheat tracts is 5 annas in Broach, 9½ annas in Ahmedabad, and 8 annas in Surat and Kaira. *Deccan* area about 1,050,000 acres:—Khandesh and Nasik have 300,000 acres each, Ahmednagar 225,000 acres, Poona 100,000 acres, Sholapur and Satara 125,000 acres, between them. Rust partly resulting from cold reported generally prevalent; irrigated, wheat more [illegible] than dry [illegible]th and just the contrary in South; also slight injury from rats in parts of Sholapur. Yield will be below average almost everywhere. *Karnatic* area about 575,004 acres;—Dharwar 800,000 acres, Bijapur 175,000 acres and Belgaum 100,000 acres. Here also rust is prevalent especially in black soil and river-bank villages, slight injury from rats in parts of Bijapur. Yield everywhere below average. *Sindh* area about 250,000 acres of which over half is in Shikarpur alone. In spite of injury from frost the crop is reported to be average in Upper Sindh Frontier and Thar and Parkar; in Shikarpur the crop is promising. *Native* states area about 700,000 acres:—Katthiawar 300,000 acres, Baroda 1000, 000 and the rest mostly in Guzerat and Southern Mahratta States. Condition generally similar to that in the neighbouring British Districts.

Prospects of the Wheat Crop in Berar.

The report up to the 15th February 1887 is as follows:—Acreage under wheat 15 per cent. above the average, which is 807,000 acres. The crop is now being reaped Its condition on the whole good and an yield of from 12 to 14 annas is estimated. The outturn of the staple food crops *jowari*, (great millet) of the people was an average one. The information is based on returns up to 15th February 1887.

Prospects of the Linseed Crop in Berar.

The report up to the 15th February 1887 is as follows:—" Acreage under linseed 392,372 acres or 36 per cent. less than last year. The decrease is due chiefly to excessive rainfall at sowing time. The crop has suffered generally from untimely rainfall, and the outturn is estimated at from 10 to 12 annas. Date of estimates 15th February 1887.

Second General Memorandum on the Prospects of the Wheat Crop of the Season 1886-87.

The second report for the season of 1886-87 have now been received and the following particulars regarding the present condition and prospects of the current wheat crop are published for general information. In the Punjab, the area under wheat at the end of January was estimated at 6,900,000 acres as against the December estimate of 6,857,002 acres. In the districts near the Himalayas, there has been good rain but none in other tracts. Later reports indicate that crop prospects are at present unfavourable owing to the absence of rain which is urgently needed generally throughout the Province. In the North-Western Provinces and Oudh, for which the report received is up to 22nd February, the regular winter rains did not set in till the 4th January when the showers that fell during that month were plentiful and greatly benefited the crop. Fungoid disease which affected the wheat was, however, caused by the appearance of cloudy weather, and in February the early crops on outlying unwatered lands suffered severely from frost. Taking 100 to denote a full average crop, the condition of the wheat in the United Provinces in February was 75. From other sources it is learnt that the *rabi* crops are in excellent condition everywhere and that harvest operations have begun in some places. The rainfall of December and January has greatly improved the wheat crop in the Central Provinces, where, however, in some places, and principally in the Nimar district, it induced an attack of rust which did great damage. A fair wheat crop is anticipated and the harvest will probably be an exceptionally good one over a large portion of the Nagpur and Wardha districts. The area placed under wheat in the Damoh, Jabalpur, Seoni, Nimar, Wardha, Nagpur, Bhandara, Balaghat, Raipur and Bilaspur districts is in excess of last season's area. and the estimated outturn (in annas?) per rupee, taking 16 annas to represent an average crop, varies from 10 annas to 16 annas in the districts from which reports have been received. From later reports it is gathered that the harvest has commenced in the Seoni, Hoshangabad, Khandwa, Raipur and Bilaspur districts. The total area placed under wheat in the Bombay Presidency, for which the report is up to the 20th February, amounts to 2, 250,000 acres distributed as follows:—

	Acres.
Guzerat	375,000
Deccan	1,050,000
Karnatic	575,000
Sind	250,000
Native states	700,000
TOTAL	2,950,000

In Guzerat, injury from frost and rust has been reported from parts of every district. The estimated yield in the chief wheat tracts is 5 annas in Broach, 9½ in Ahmedabad, and 8 in Surat and Kaira. In the Deccan, rust, partly due to cold, has been reported to be generally prevalent and the yield will, it is expected, be below the average almost everywhere. Rust is also stated to be prevalent in the Karnatic, especially in black soil and river-bank villages. As in the Deccan, the yield is below the average everywhere. In Sind, notwithstanding the injury caused by frost, the crop is reported to be average in the Upper Sind Frontier and in Thar and Parkar and promising in Shikarpur which represent more than half the total area under wheat in Sind. In the Native States the condition of the crop is generally similar to that in the neighbouring British districts. In Berar, the area under wheat as ascertained in the middle of February was 15 per cent. above the average which is 807,000 acres. The crop is being gathered and a yield of from 12 to 14 annas is anticipated. A report recently received from Rajputana estimates the area under wheat cultivation in 1886 in eight States to be 951,990 acres, but complete statistics for the whole Agency are not yet available. So far, however, as can be gathered from other sources, the prospects of the wheat crop both in Rajputana and Central India are on the whole favourable, though in both Agencies some injury has been caused by frost. In Hyderabad and Mysore, the prospects and condition of the wheat crop are generally satisfactory. The general condition of other food-grains and non-edible food crops continues favourable. In Bombay, the rice and gram crops are being harvested, and in Berar the outturn of the staple food crop, *jowari* (Great Millet), was an average one. In Bengal, the winter rice has yielded well. In the Central Provinces some distress has been felt by the people owing to the failure of the rice crop. Rice is largely consumed by them in the districts of Chanda, Bhandara, Balaghat, Raipur, and Bilaspur, and the crop owing to the lack of rain was not more than a half crop in the three districts first named, while in Raipur and Bilaspur it gave an outturn of only 2 annas in the rupee or even less over a very large portion of the country. On the other hand, millets, which are in the Central provinces the food crop next in importance to wheat, have, speaking generally, yielded a fair crop. The food crops of the people which have been principally affected in the North-Western Provinces and Oudh are *arhar dhal*, gram and peas. Fully half of the first and much of the other two have been destroyed by frost. In other parts of the country, so far as is known up to date, the condition of the food crops other than wheat is satisfactory, and there is no reason at present to apprehend any diminution in the proportion of the wheat harvest available for exportation.

The supposed normal wheat area of each Province is quoted below:—

	Supposed normal wheat area. Acres.
Punjab	7,000,000
North-Western Provinces and Oudh.	5,037,000
Central Provinces . . .	4,000,000
Bombay (including Baroda).	1,883,000*
Berar	807,000
Bengal (Behar) . . .	850,000
Rajputana	2,500,000
Central India	2,500,000
Hyderabad	750,000
Mysore	20,000
Kashmere	500,000
TOTAL .	25,847,000

France

In the discussion in the Chamber of Deputies upon the Budget of the Ministry of Agriculture great stress was laid upon the economic position of the United States as a result of Protection. Coming to details attempts were made without success to increase the nine regional shows to the old number of twelve, and to suppress the post of Director of the State-Stud (Haras). M. Deville took high ground on the latter point, threatening resignation if this backward step were voted, and the Chamber backed him up by 355 votes as against 197. A development of the technical school system is contemplated in aid of the Beet-sugar industry. M. Deherain, the president of the Association of Chemists of the Refineries and Distilleries, is at the head of the movement; he has enforced his views at a general meeting of the Association and being well supported by M. Dupont, the secretary, he has succeeded in passing a resolusion em-

* Inclusive of Baroda but exclusive of the other Native States under the Political control of the Government of Bombay.

bodying the need of such schools. The Bureau of the Association are now charged with the realisation of the project.

Madras Crops.

The following statement shows at a glance the total area harvested and that which was estimated to yield a full, average, indifferent, or poor crop.:—

Name of crop	Total area harvested.	Percentage of area on which a 20-anna crop was estimated	Percentage of area on which a 16-anna crop was estimated	Percentage of area on which a 8-anna crop was estimated	Percentage of area on which a 4-anna crop was estimated	Total estimated yield
	ACS.					LB.
Paddy	2,408,586	15·3	33·6	34·3	16·8	2,576,558,173
Cholum	1,938,586	5·5	38·5	36·8	19·2	679,073,651
Cumboo	1,999,723	4·7	31·3	46·8	17·2	581.743,012
Ragi	945,500	4·7	38·7	44·1	12·5	388,829,253
Indigo	331,205	11·1	51·8	27·8	9·3	6,780,244
Castor and lamp oil seeds	89,223	6·1	46·1	40·2	7·6	Average production per acre not determined.
Gingelly-oil seeds	410,388	5·4	28 2	41·2	25·2	

It will be observed that the outturn of all the crops was fair, the percentage of the area on which a full or average crop was raised not being much under 40 per cent. in any case with the exception of cumbu and gingelly-oil seeds. The following statement represents the condition of the standing [illegible] ...enth r

Name of crop	Total area of standing crops.	Percentage of area on which a 20-anna crop is estimated	Percentage of area on which a 16-anna crop is estimated	Percentage of area on which a 8-anna crop is estimated	Percentage of area on which a 4-anna crop is estimated	Total expected yield in lb.
	ACS.					LB.
Paddy ...	2,077,161	10·1	38·9	34·1	16·9	2,146,508,033
Cholum ...	958,984	6·2	34·1	43·2	16·5	298,263.598
Ragi ...	211,860	5·8	38·5	41·3	14·4	91,403,4.5
Sugar cane	32,711	19·1	44·4	33·7	2·8	1,264,198

A full or average outtern was expected over 40 per cent. of the area under all the crops. The condition of the sugar-cane plants seems to have been exceedingly satisfactory, as the area on which an indifferent or poor crop was expected is only 36 per cent. Subjoined is a statement showing the area cultivated under all the crops and that harvested up to the beginning of the year ;—

Name of crop	Total extent cultivated up to the end of December 1836	Total extent harvested up to the end of December 1886	Difference between cols. 2 and 3	Percentage of cols. 2 and 3
1				
	ACS.	ACS.		
Paddy	5,226,524	2 408 586	2,817,938	46
Cholum	3,419,466	1,938 956	1,480,510	57
Cumbu	2,329,501	1 999,723	329 778	86
Ragi	1,241,598	945,500	296,093	76
Indigo	378,236	331,205	47,031	88
Gingell oil seeds	516 079	410 388	105,691	80
Caster and lamp-oil seeds	655,344	89.223	566,121	14
Sugar-cane	40,928	4,315	36,613	11

The area harvested is over 75 per cent. of the total cultivation in the case of cumbu, ragi, indigo, and gingelly-oil seeds. In the case of paddy and cholum, 46 and 57 per cent. of the area cultivated had been harvested at the end of 1886. The season during the nine months of the year ending with the 31st December 1886 was on the whole favourable, though the north-east monsoon was not satisfactory. The average rainfall during the period was 46-65 inches which, exceeded that of last year and that of the preceding five years *by about 3 inches.*

France.

The period of beet sugar manufacture has now been brought to a termination. During January only 42 factories out of 388 were at work. The total produce up to the 15th of that month was 366,811,000 kilogrammes, or 132 million kilos more than at the corresponding date of 1886. About 1,71500 tons of beet gave 1 per cent. and some 36100 tons 6 per cent. The quality was generally recognised as good and the prices paid to farmers were remunerative. The annual production of milk in France is about 1,600 million gallons, worth £48, 000,000. The total yield of wool is about 1 million lb., of the value of £3,200,000.

RELATION OF TEMPERATURE TO PLANT GROWTH.

(*By Professor J. H. Gilbert.*)

At the meeting of the Swiss society held at Geneva last August, Professor J. H. Gilbert, L. L.D. F. R. S. read before the Botanical Section a valuable paper, which has since appeared in the *Archives des Sciences physiques et naturelles* under the title Remarques sur la relation qui existe entre les summers de temperature et la production agricole." It is an investigation into the amount of heat necessary to the growth and ripening of certain crops, particularly wheat, and the following is an abstract by Professor Tream of the salient features of the memoir. The subject has already been to some extent studied by Boussingault, who attempted an estimate of the capacity of different countries for the production of cereals. De Candole likewise has discussed the influence of the several meteorological factors upon the growth of plants, indicating at the same time the best methods of observation and calculation for overcoming the difficulties which are encountered in the application of meteorological data to the study of the phenomena of vegetable life. Professor Gilbert premises that in 1878 the Meteorological Office in London published weekly bulletin drawn up especially for the use of persons engaged in agriculture, or in matters relating to public health. In December, 1881, the Office issued a circular inquiring of agriculturists what meteorological statistics were most useful to them, and under what form they might be conveniently presented. In reply, Messrs. Lawes and Gilbert suggested, amongst other proposals, that the total temperature above a fixed point conveniently chosen should be calculated and noted in various seasons and in different places, so that it might be possible to ascertain to what extent these data might be utilised in investigating the relations between temperature and agricultural production. They further suggested that it was desirable to register the total number of hours of insolation (that is exposure to sunlight) and of rain. Attempts had previously been made at Rothamsted to estimate the effect of temperature upon wheat growth. At the time, only the monthly mean temperatures published at Greenwich were available, so March 1 and April 1 of [illegible] taken as marking the beginn[illegible]ant-growth, [illegible] of harvest at Rothamsted as marking [illegible] period of vegetation. By deducting 43 deg. F, (i. e. as registered on the thermometer commonly used in England) from the mean temperature of the month, and multiplying the difference by the number of days in the month, and then adding together the products for the entire period, a figure was obtained which was regarded as representing the total number of degrees of effective temperature. Distrusting the monthly means, it was decided to collect the daily mean temperatures for a great number of years in order to arrive at more exact results. General Strachy, President of the meteorological Office, established a formula giving the true value of the daily mean, deduced from temperatures registered from hour to hour and he compared the result thus obtained with those arrived at in the usual way, which consists in taking each day the mean between the maximum and minimum temperatures. He found there was almost no difference in the winter but rather more in the summer, that is, during the season when these data are most important in their application to vegetation. For a certain period of 1881, for example, the formula fixed the sum of temperatures at 1, 623, whilst the ordinary method gave 1,664. The following year the formula gave 1,525 as against 1,578. The Meteorological Office published in 1884, for the use of agriculturists the amount of daily temperature below or above 42 degs. for each week as well as the amounts registered in January. The same sums have been calculated retrospectively to 1878 inclusive. In the Rothamsted researches the method followed was to calculate the sum of degrees above

42 from certain dates arbitrarily chosen, such as January 1, February 1, March 1, April 1, until the cutting of the experimental wheat crops there grown. The totals from the first week of excess sensibly continued, and also from each renewal of excess succeeding to a temporary insufficiency of temperature were also estimated. In a table, which is not reproduced here, are shown—for 27 years (1852-78) the maximum and minimum sums of temperature above 42 deg. F. registered at Greenwich, and calculated respectively from January 1, February 1, March 1, and April 1 of each year until the wheat harvest at Rothamsted, monthly means being informed. For six years (1871-76) the maximum, minimum and mean above 42 deg. F. during the same periods but calclutted according to the daily means at Greenwich. The same maxima and minima likewise their means from 1878 to 1885 still determined from the same dates; and further, the excess of temperature from each of the initial epochs to harvest, estimated from the commencement of the first excess sensibly continued and also from each renewal of excess after an insufficient temperature, these calculations being likewise based upon tables of sums of weekly by the Meteorological Office. Commenting upon this table, it is observed.—That in deducing the mean results for 27 years from the monthly means only, there is very little difference between the totals, whether calculated from January 1, February 1, March 1, or April 1. In fact the mean sum of degrees of daily excess over 42 deg. up to the time of harvest is 1124 starting from January 1,1121 from February 1,1113 from March 1 and 1100 from April 1. The evident explanation of this uniformity is that in our climate there is little excess of temperature above 42 deg. before April 1. In confirmation of this the meteorological tables show that in almost all of the 27 years there was no excess in the month of March, still less in February, and only in two years any excess in January. In the six years' calculations, based on the daily means at Greenwich the differences are greater. Thus, the sums of degrees of daily excess are 1216 from January 1 to harvest, 1190 from February 1, 1166 from March 1, and 1116 from April 1. The results obtained by the more exact method, but for eight years only, give for the four periods from January 1, February 1, March 1, April 1, the means of 1058, 1031, 1003, and 943 deg. respectively. It appears, finally, that the excess of the daily mean temperature over 42 deg. was represented by the number 1120 during the period of 27 years, by about 1100 during the six years, and about 1060 during the period of eight years. Boussingault had already estimated these totals for winter wheat in four, and for spring wheat in six countries, situated far apart, and presenting amongst themselves great differences, both as regards duration of growth and as regards mean temperature. Moreover, he took account of all degrees above the freezing point (32 deg. F.). Bringing his figures into conformity with those obtained by starting from 42 deg. as the initial temperature, the result is, for winter wheat, 1,316 deg., and for spring wheat 1,528. Consequently, Boussingault's values are higher than those obtained at Rothamsted. But, if it be borne in mind that his calculations are based only upon general estimates of the mean duration of growth for the several countries, taking as the initial point for winter wheat the cessation of frost, and taking for spring wheat the time between sowing and reaping, and remembering that he adopted a mean temperature for the whole period of growth, we are impressed rather by the exactitude of Boussingault's results than by their differences from those obtained at Rothamsted. Herve-Mangon, who experimented in the north-east of France, established a mean of 1,924 deg. for wheat, during a period of eight years, calculating from March 1 to harvest. He took no account of temperatures below 42. 8 deg. F. when the mean did not attain this temperature, but, otherwise, he noted all the degrees. Reducing this figure in the same way as was done with Boussingault's, so as to take into consideration only degrees above 42 F. gives a mean of 1,030 deg. a number much nearer to the Rothamsted figure than to Boussingault's. M. E. Risler has made similar observations for six years near Nyon, Switzerland. The mean of his results gives 2,134 deg. from seed time to harvest, but he registered all degrees above freezing point whenever the mean temperature exceeded 42·3 deg. F. Subtracting from this number the product of 5·55 deg. Centrigude (equal to 42 deg. F.) by 165 days of mean duration of growth we obtain in the remainder, 1,218 deg., a value quite comparable with the results of Bousingault and Harve-Mangon. Both the investigators just named have also experimented upon barley, and Boussingault further upon maize and some other crops. For spring sown barley, the means of observations made in four widely-distant localities, calculated from sowing to reaping, gave Boussingault a sum of 1,772 deg. above freezing point, equivalent to 1,114 deg. above 42 deg. F. For winter barley the mean of these values, calculated from the termination of frost, was 1,798 deg. starting from freezing point, equivalent to 1,152 deg. above 42 deg. F. The mean of the values obtained by Herve-Mangon in six consecutive years, in the case of barley, was equivalent to 1,105 deg. F. a

result closely approaching that of Boussingault. Maize requires for its growth and maturation a temperature more elevated and of longer duration than does wheat. The mean of Boussingault's values, relating to seven widely distant localities, gives for this crop a number equivalent to 1,953 deg. above 42 deg. F. a sum much higher than any of those correspondingly established for wheat and barley. The results arrived at in the case of wheat can leave no doubt that there is a large basis of truth for concluding that there exists an approximate uniformity in the total amounts of heat necessary to bring wheat plants from their commencement of growth to their final ripening. The total amounts required by barley are about the same as those necessary for wheat, whilst in the case of maize the amounts are much higher. Various difficulties surround the whole subject. Is it safe to adopt 42 deg. F. as the initial temperature? In the total sum should only the degrees above the initial temperature be included, or all degrees above freezing point? According to Boussingault, the temperatures at which various plants can grow vary from 37 deg. or 39 deg. F. to 100 deg. or 120 deg. F., and De Candolle has published tables showing the great differences which exist between the sums necessary to growth, according as 34, 35, 36, &c., deg. are taken as initial temperatures. It is probable that both wheat and barley are capable of growth at temperatures below the initial one adopted, namely, 42 deg. F. Another source of difficulty lies in the circumstance that the same mean excess above a fixed point may be consistent with very different maximum and minimum temperatures; the minimum may be such as to arrest growth in some cases and not in others, whilst the maximum may be above the temperature which is most efficacious; moreover, the same temperature might produce different results, upon the same extent of plant surface and in the same time, according to the stage of growth and to the degree of humidity of the environment. A system of detailed meteorological statistics made concurrently with careful agricultural observations, repeated periodically over a large crop, is alone able to convey a truly clear idea as to the relation between the incessantly variable characters of the season and the equally changeable circumstances peculiar to plant growth. It is, in fact, the distribution of the different meteorological factors which make up the season that is of the highest importance, and it sometimes happens that accidental conditions, incapable of being indicated in meteorological tables, influence the crop in a remarkable manner. As illustrating the last-mentioned point it will be useful to compare the influence of the duration of exposure to sunlight (i.e. insolation) with that of the total temperature upon the progress and intensity of plant growth. In our English climate, which is not characterised by an abundance of sunny days, the period of the year containing the days of greatest insolation much precedes that which has the highest mean temperature, and during which the greatest accumulation of carbon takes place over a given area of cereal crop. This accumulation, indeed takes place chiefly during the period of highest mean temperature. According to the data of the Meteorological Office, during six years (1880-85), the week presenting the greatest number of days of insolation, in the district around Rothamsted fell six times in May, thrice in June, and three in July; whilst, in the same district, the week of highest mean temperature occurred six times in July, four times in August, and twice at the beginning of September. Thus, the period which contains the greatest number of days of insolation takes place generally some time before the longest day of the year, or, in other words, before the epoch which is capable of affording the greatest possible insolation, whilst the period of highest temperature generally occurs several weeks later.

It may here be of interest to mention that, in some years of the Rothamsted experiments, it was found that in the wheat crop the quantity of carbon has more than doubled in five weeks from the 21st of June; that is, the greatest accumulation of carbon over a given area took place after the period of greatest duration of insolation and occurred on the approach of the season of highest temperature.

It is to be observed, in conclusion, that this study of the practical application of total temperature to the phenomena of plant growth affords a direct proof of the modifying influence exercised by the other meteorological factors. It shows, therefore, the neccessity of having recourse to a careful and detailed observation of all these factors and of their adaptatoin to the character as well as to the state of development of the plant itself. I should add that I have throughout given the sums of temperature in degrees Centigrade; the numbers should be nearly doubled, or, more accurately multiplied by nine-fifths, to give the equivalents in degrees of the thermometer (Fahrenheit's) which is in household use in England. This, however, would not alter relative values, nor, therefore, would it affect the results in cases of comparison.

"The Mark Lane Express."

CROP AND WEATHER REPORTS.

For the week ending 2nd March, 1887.

General Remarks.—The week under review has been [illegible]

No reports has been received from Madras and Coorg.

The rabi harvest is now in progress in Bombay, Be[illegible] the North-Western Provinces and Oudh, the Central Provi[illegible] and in Berar and Hyderabad; the crops are generall[illegible] excellent condition, and a good outturn may be anticip[illegible] In the Punjab the prospects of the rabi are unfavou[illegible] generally throughout the Province owing to the absen[illegible] rain, which is urgently needed. In Central India and [illegible]putana crop prospects are generally good, though injury [illegible] frost in Meywar and Kerowli is reported. In Mysore [illegible] outlook is favourable.

The spring rice is being transplanted in Bengal and land is being ploughed for the early rice there and in A[illegible] where sowings have commenced.

Poppy is in flower in Bengal. In the North-We[illegible] Provinces and Oudh the collection of opium has just [illegible]ced and the crop promises well.

[illegible] in Bengal, the North-[Wes]tern Provinces and Oudh [illegible]ssam. Scarcity of fodder is reported from parts of Dharwar in the Bombay Presi[dency] and from Shahpur in the Punjab.

The public health is generally satisfactory.

Prices are fluctuating in the North-Western Provinces and Oudh, are still rising in the Punjab and some States in the Rajputana Agency, and are also high in Jabalpur in the Central Provinces. Elsewhere they are generally steady.

For the week ending 9th March, 1887.

General remarks.—Except in parts of Bengal and [As]sam and two districts of the Punjab, the week under repo[rt has] been rainless.

The rabi harvest is in progress generally throughout [the] country and has been completed in Berar. The crops [are] on the whole in a promising condition, though in Bombay, the North-Western Provinces and Oudh and Rajputana frost and blight have caused some injury. In the Punjab the prospects of the rabi have not improved, and rain is still urgently wanted everywhere in the Province.

In Madras the standing crops are in want of rain and prospects are only tolerably fair. The outlook in Mysore and Coorg continues satisfactory.

The spring rice is doing well in Bengal, and ploughing for the early rice is proceeding in Assam.

The sugarcane harvest is in progress in Madras and Bombay.

The collection of opium has commenced in Bengal and the North-Western Provinces and Oudh. In Central India and Rajputana the crop is generally fair.

In Bengal indigo sowings are in progress.

Except for an outbreak of cholera in Benares, the public health is generally satisfactory in all Provinces.

Prices are fluctuating in the North-Western Provinces and Oudh and the Punjab, are falling in Mysore and Coorg and are high in some districts of the Central Provinces and in [illegible] States in the Rajputana Agency.

[illegible]

For the week ending 16th March, 1887.

General remarks.—There has been heavy rain in Assam during the week under report, and showers have also fallen in most parts of Bengal. In the North-Western Provinces and Oudh and the Punjab slight rain fell in six and four districts, respectively.

The rabi harvest continues in Bombay, Bengal, the North-Western Provinces and Oudh, the Central Provinces, Berar and Hyderabad, and prospects are everywhere very favourable. In the Punjab the want of rain is still much felt, and the prospects of the rabi are unsatisfactory. The rabi harvest has commenced in Rajputana, and the prospects of the crops there and in Central India are generally good. In Madras the standing crops are suffering from the want of rain, and prospects are only tolerably fair. In Mysore and Coorg the outlook is favourable.

The prospects of the spring rice in Bengal are promising, and ploughing for the early rice still goes on there and in Assam.

The collection of opium progresses in Bengal and the North-Western Provinces and Oudh, and the prospects of the crop in Central India are fair.

Indigo sowing is proceeding in Bengal where the tobacco crop also promises well.

Except for the outbreak of cholera in Benares the public health continues satisfactory in all provinces.

Prices are fluctuating in the Punjab, but are generally high. Elsewhere they are generally stationary.

For the weeks ending 23rd and 31st March, 1887

General Remarks.—In the latter half of the fortnight under report rain fell in most parts of Madras, Bengal, and Assam. Slight falls have also occurred in a few districts in the North-Western Provinces and Oudh, and Punjab, and Burma. Elsewhere the country has been rainless during the period under report.

The 'rabi' harvest continues in most parts of the country, and has been partly completed in Bombay, the Central Provinces, and Berar. Prospects are generally good, except in the Punjab, where the state of the crops is unfavourable, owing to the want of rain. In Rajputana harvesting has commenced in a few States.

The standing crops are generally fair in Madras, though in some districts blight and want of rain have caused slight damage to the crops.

In Mysore and Coorg the outlook is satisfactory.

The prospects of the spring rice are favourable in Bengal the sowings for the early rice have commenced in Assam.

The collection of opium is in progress in Bengal and the North-Western Provinces, and a fair outturn is expected, except from Allahabad, where the crops were damaged by hail. The prospects of the crops in Central India and Rajputana are fair.

Cholera and small-pox are prevalent in parts of Madras, Bombay, Bengal, the North-Western Provinces, and Burma, but generally the public health is good.

Cattle-disease exists in some districts in Madras, Bombay, Bengal, and Assam.

Prices are still high in the Punjab, though they are falling in the Amritsar and Sialkot districts. Elsewhere they are steady.